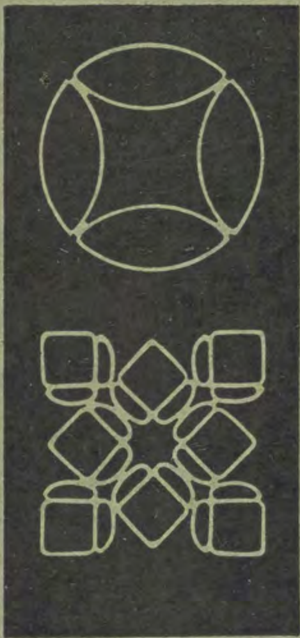
UNIT JEWELLERY

A HANDBOOK IN SIX PARTS

BY R. LL. B. RATHBONE

VERY FULLY
ILLUSTRATED
THROUGHOUT



EACH PART
MAY BE HAD
SEPARATELY

CRAFTSMANSHIP
WITHOUT DESIGN
IS LIKE A VESSEL
HAVING NO PILOT

PART
IV

3^{50}

UNIT JEWELLERY

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VEL E MINIMIS PULCHRITUDO

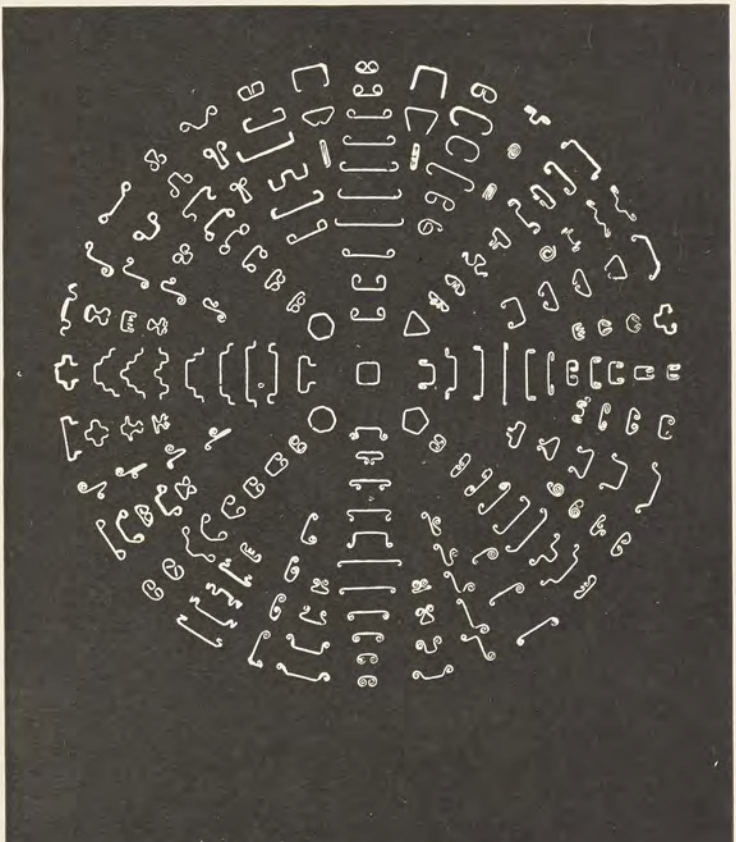

FIG. 14B.—Units of the staple type.

UNIT JEWELLERY

A HANDBOOK FOR CRAFTSMEN IN SIX PARTS (SOLD SEPARATELY) ILLUSTRATED WITH MANY DRAWINGS BY THE AUTHOR AND WITH A PROFUSION OF PHOTOGRAPHIC SILHOUETTES OF ORNAMENTS AND DETAILS MADE BY HIM FOR THAT PURPOSE AS ALSO WITH PHOTOGRAPHS OF TOOLS AND OF SOME EXAMPLES OF JEWELLERY SELECTED FROM NATIONAL & PRIVATE COLLECTIONS

BY R. LL. B. RATHBONE

PART IV

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PART IV

CHAPTER XXXIV

BUILDING PATTERNS WITH UNITS

IN Figs. 76, 77, 78 and 79 there are some suggestions of what can be done with a few of the other units taken from Figs. 14 to 14D, showing how these may be used either separately or in conjunction with one another, though in these ornaments, as a matter of fact, there are never more than five different units in any one design. In a few instances small round or oval rings have been allowed, where they seemed to be wanted, although, of course, these were made from shorter lengths of wire than the other units.

In several cases where the pattern constructed took the shape of a frame or wreath, another smaller arrangement was placed inside when the examples were laid out for photographing; but this does not necessarily mean that they were designed to be associated together in this way, one object having often been the economy of space in the photograph.

Many of these, and especially the arrangements in Figs. 69 and 73, make no pretence of being much more than mere skeletons; but they do claim to be skeletons from almost any one of which a pleasant piece of jewellery might easily be made. They are, however, flat skeletons, and they need the introduction of other contrasting planes, and of an element of mystery, to be obtained by occasional interruptions of their lines, and by the partial covering of their bones and joints with some of the many other forms in

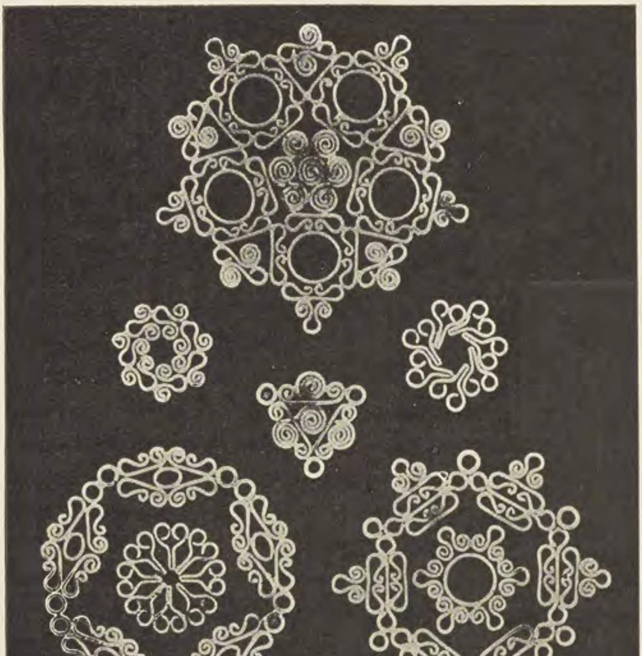


Fig. 76.—Ornaments built up out of the units indicated.

which the jeweller can employ the precious metals, or else with some of the other materials which are at his disposal.

In constructing the more varied ornaments up to the stage at which they are illustrated in the present chapter, Figs. 76 to 79, the only other units which have been employed in addition to those selected from Figs. 14 to 14D are, with one exception, small round rings ; and without going further afield than is necessary to obtain the various other circular forms, whose evolution was traced in Chapters I. to IV., a judicious use of grains, discs, and domes, in various sizes, might be made to do much towards completing them. Moreover, convenient places are generally left for the setting of precious stones by the way in which the units repeat themselves in the formation of patterns, and, in some cases, nothing more would be necessary thoroughly to knit the design together, and to provide centres or points of special interest, than a few precious stones in appropriate settings.

The flatness of these combinations of units is not at all essential to their construction, though, of course, it is easiest to solder them together when they are lying on a level surface of charcoal ; but there are various other ways of building them up so that the finished object will perhaps have several varying degrees of relief in its composition, apart from any extraneous additions, such as discs, domes, stones, etc., which may be applied to the surfaces here and there.

Moreover, a slight degree of curvature is easily given to such objects as these after soldering, by careful tapping on the sandbag (see Fig. 27, p. 73), or in one of the larger hollows of the doming block ; and it is astonishing how very much the work may be altered and improved by even a very slight amount of doming.

It will be observed that many of these designs strike the eye most noticeably by reason of the repetition of any straight lines which the units employed may contain, and that most of those which have come out best are strong in this respect. A design made up out of a repetition of small units based on an obvious and simple geometric form, if it

is kept very small indeed, may look well enough, even if it has no straight lines whatever in its composition. But it is

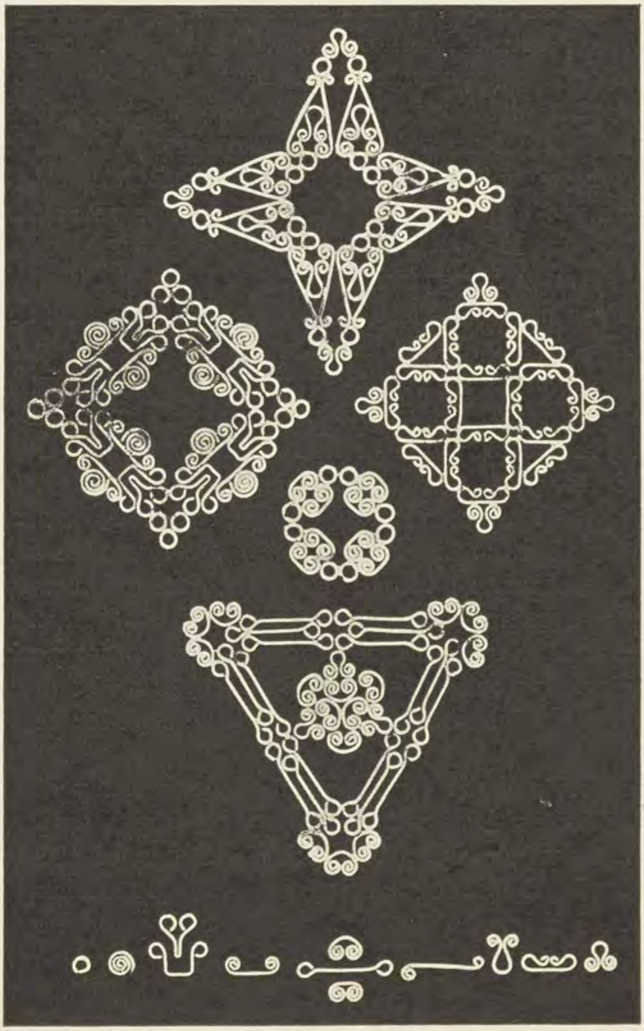


FIG. 77.—Ornaments built up out of the units indicated.

a pretty safe general rule that without a reasonable proportion of straight lines most patterns will be restless and unsatisfactory.

The patterns illustrated in Figs. 76 to 79, and others similarly obtained, are also very suitable for enrichment with enamel, providing, as they do, a variety of cells for the reception of different colours. From that point of view, and, indeed, from the point of view of the designing of ornament generally, this method of inventing and constructing patterns seems to be capable of wide application.

The illustrations, shown as they are, for convenience' sake, in white upon a dark ground, seem at once to suggest inlaid work, or, from the jeweller's and metal-worker's point of view, niello work. This process is generally used for filling engraved plates with a black metallic composition, which may either represent the forms of the designs themselves, or the background which expresses them, if this has been cut away; and there does not seem to be any reason why units made of silver wire should not be given a background in this way also. The niello composition, being itself partly composed of silver, is rather expensive; but that would only mean that the spaces left between the units must be small, as also the objects so constructed or decorated, and that the units must be made of narrow wire, so that the background filling of niello composition shall be thin.

A simpler application of the same idea is to use these forms and the patterns produced by means of them for the ornamental inlaying of woodwork in the Indian manner.

Units intended for that purpose should be made of "knife-edge" wire, that is to say, of wire which, instead of being oblong in section, has a narrow flat top and a sharp edge at the bottom.

Although the advice given on p. 139 to stick to the length that has been chosen for a considerable time is probably *good* advice, still it is not meant to be followed *against the judgment* of any reader who feels confident of having mastered the elements of the craft. Occasions are sure to arise from time to time when wires of a length different from that which has been adopted as a standard length for regular use will be necessary for the proper execution of the work in hand.

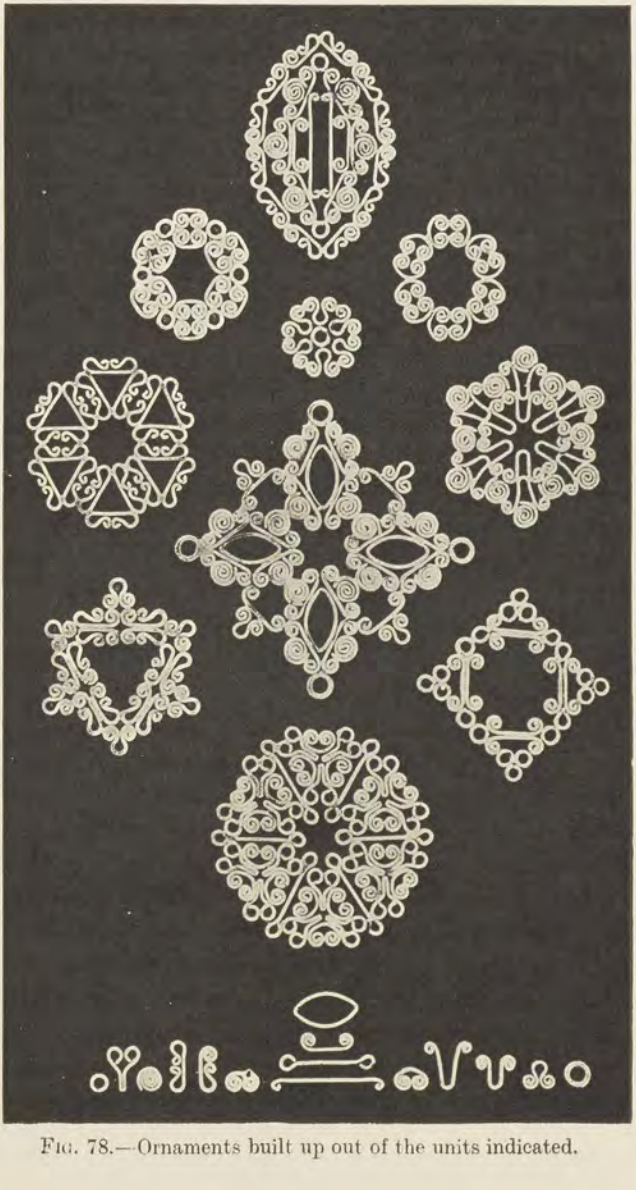


FIG. 78.—Ornaments built up out of the units indicated.

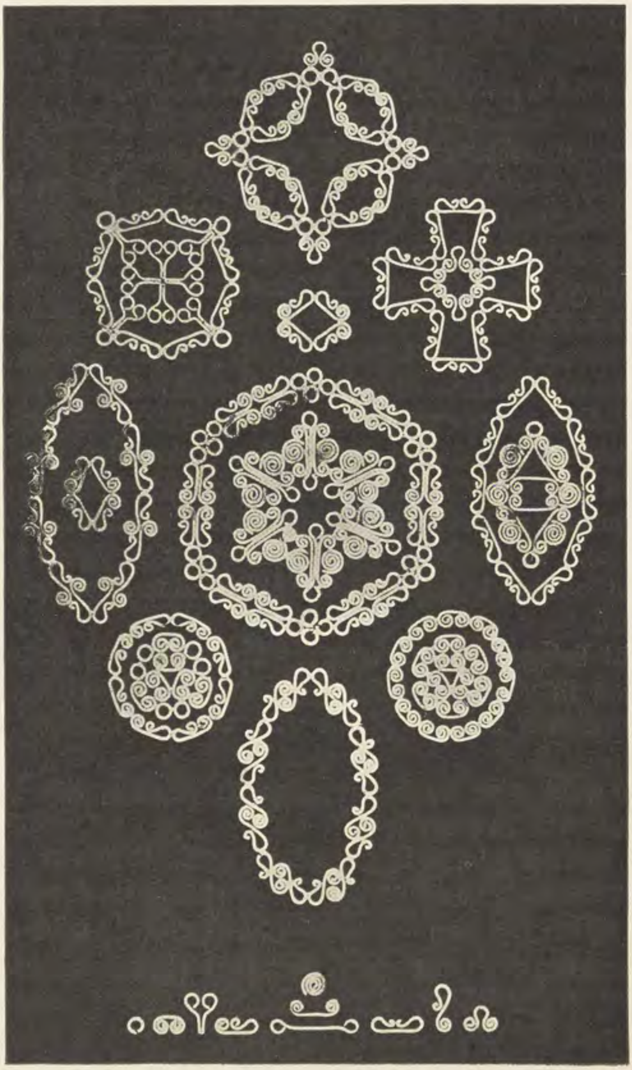


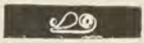
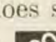
FIG. 79.—Ornaments built up out of the units indicated.

For one reason or another, the author has not made more than very rare use of any of the units illustrated in Figs. 14 to 14D since the time when "Simple Jewellery" was first published until quite recently in making new illustrations for this book, but on those occasions when he has done so, and has referred to his alphabet of units for something suitable to the work in hand, he has several times found that some fresh modification was preferable, generally a modification in the proportions of the bits of wire used, which has materially altered the appearance of the resulting unit when it has been formed on lines similar to those of one of the units in the alphabet.

The modification will most often take the direction of an increased length of wire. When you go on from silver to gold or platinum (if indeed that metal can legitimately be used at all for purposes of ornament when the small quantity of it which is produced seems to be insufficient for its numerous scientific uses) you will find that the preciousness of the material suggests a different section for the wire. The *width* of the flat wire may very well remain much the same, but its thickness will need to be considerably reduced.

That being so, let us suppose that you have decided to express, in gold, the form  which looks all right in silver when it is made of the wire we have been using all along.

The gold wire is, however, much thinner, say in the proportion of 1 : 3 perhaps.

By increasing the length of wire which is cut off for each unit so as to allow some extra turns for the scrolled ends, which gives us , this unit, in spite of the greater length of wire used, does still require a decidedly smaller weight of metal than , and it is daintier in form, and therefore more appropriate to gold. On the other hand, it is a good deal more trouble to make, and therefore less appropriate for use in the less precious metal for which the bolder form is entirely suitable.

CHAPTER XXXV

LOOPS FOR BUTTONS AND CLASPS

ANY reader who has pursued the foregoing instructions up to this point will probably have accumulated plenty of material out of some of which he will naturally be wanting now to build up completed pieces of simple unit jewellery. But, in order to do this in a workmanlike fashion, he will need to have some knowledge of a good many other processes, which we will take as the need for them arises in the ten following chapters.

Such things as those illustrated in Figs. 5, 6, and 9, and in Figs. 76 to 79, might some of them be made into buttons, clasps, brooches, hat-pins, scarf-pins, tie-rings, chains, pendants, necklaces, hair ornaments, shoe buckles, napkin-rings, menu-holders, and so on.

It is a good plan to begin with the simplest thing of all, say a button, except perhaps for the fact that *one* button is not likely to be of very much use by itself, unless, indeed, as a sample from which to take orders for others, and probably you won't want to start out on repetition work. But then, on the other hand, a set of buttons may all look very much alike at a first glance, and yet when examined more closely they may prove to be all slightly different.

In some cases it might be an advantage to begin by soldering a disc of thin sheet silver to the middle of the back of the button, in order to provide a good attachment for the two ends of the wire loop by which it will eventually be sewn on to the garment which it is destined to adorn. But if you do that, then be very sure that the solder adheres

to both disc and ornament at enough points to hold them firmly together, because buttons do sometimes have to bear considerable pulling. In any case, take care to get a good and sufficient bearing for the solder which fixes the two ends of your wire loop to the back of the button. One method which answers well is to finish each end of the wire loop with a round turn, or better still, with a close scroll as in Fig. 80. This loop is made by doubling a piece of round wire, of suitable length, and twisting it until a long enough shank has been made. The remaining ends are then straightened and made square in section by lightly hammering them on the steel stake (p. 72). It may be wise to anneal the wire at this stage before curling these ends up into close scrolls. The scrolling would be rather too difficult if the wire were allowed to remain round in section. At the left-hand side of the illustration the loop is shown as it looks when it is ready for the ends to be scrolled.

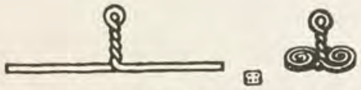


Fig. 80.—Loop for the back of a button.

The advantage of these forms is two-fold, because not only do you get an admirable bearing for making a strong soldered joint to secure the loop to the ornamental part of the button, but also incidentally your loop stands upright by itself quite steadily during the process of soldering it on to the inverted button, when that is placed face downwards either on the charcoal block or on the soldering wig, and that is a real saving of trouble.

The extent to which the loop projects from the back of the button should be decided with due reference to the thickness of the cloth with which it is going to be used, whenever this is known.

In order to finish one of your ornaments as a clasp, you will need to make two strong loops, and one corresponding hook. The loops must be soldered across the back of the ornament, so that one part of the cloth, or other material (which it is the business of the clasp to hold), can be sewn

to one of these loops, while the hook engages in the other loop. The other side of the material which is to be held together is secured to the back end of the hook, which may, if convenient, finish in a loop, for that purpose, at its hinder end. Or the clasp may equally well be a double one, that is to say, there may be two ornamental pieces instead of only one, and these will generally be symmetrical and similar to each other. One of these will have two loops fixed across its back, while the other will have one loop and one hook.

The strain which a clasp has to bear when in use varies greatly, according to the weight of the material which it secures. Also clasps are often used when their purpose is mainly decorative.

But when it is a question of holding together the two sides of a heavy cloak, or something of that kind, the hook and the loops and all their attachments need to be stronger than might be supposed.

FIG. 81.—Loop for a clasp.

Then, too, the space allowed for the material to pass through when it is secured to the loops will necessarily vary according to the thickness of the material. It is undesirable to provide more space than is actually necessary, because that would cause the clasp to stick out untidily, but, on the other hand, it is unsatisfactory if the stuff cannot be got under the bar of the loop without great difficulty.

Let us suppose that the space which has to be left for that purpose is $\frac{1}{16}$ inch and that the size of the ornament is big enough for two cross loops, each of them about $\frac{3}{4}$ inch long, to be soldered across the back, with a proper space left between them for getting the hook easily into *its* loop after the material has been sewn round the bar of the other loop.

Fig. 81 represents an efficient form of triple-wire loop which looks well and is not very difficult to make.

First of all you want a plate of thick sheet metal round which to bend the triple wires. Assuming that you have a

vice of some sort, in which you can hold your bending-plate firmly, then a piece about 1 inch long will do.

As we are supposing that the space required for the cloth to pass through is $\frac{1}{16}$ inch high, it follows that the thickness of the bending plate must be the same, and if the outside length of the loop must not exceed $\frac{3}{4}$ inch, then, allowing for the thickness of wire at each end of the loop, the bending plate will be $\frac{5}{8}$ inch wide—so it may be 1 inch $\times$ $\frac{5}{8}$ inch $\times$ $\frac{1}{16}$ inch.

If you have no sheet metal as thick as that, a thinner piece, doubled over, will do.

In order to find out the length of wire needed for each loop you must now make a trial one by bending a bit of No. 18 I.S.G. wire round your plate. When the loop fits this, take it off, anneal it, and straighten it out again, and keep it as a measure. Then consider how much extra to allow for curling the ends round as in Fig. 82 and cut your pieces of wire accordingly.

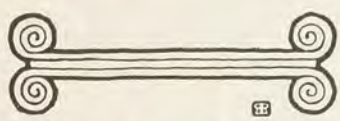


FIG. 82.—Loop for a clasp—before bending.

It will be much easier to curl the ends into the required scrolls if those parts of the wire are first made square in section, instead of being left in the round state. This is done by holding the wire so that the part of it which is to be altered lies flat upon the steel stake, and by then tapping it with a light hammer, until it is first flattened a little and then made square, but all the middle part which has not got to be scrolled is left unaltered.

When the end parts have been made approximately square in section you should anneal the wires, so as to be able to scroll the ends round easily until the extreme length is right by the measure. Then cut a straight piece of wire of the right length to go between the other two pieces, as shown in Fig. 82, bind them all together with iron binding wire, solder and pickle them, and afterwards bend the triple wire around the plate to form a loop like Fig. 81.

This is a strong construction, and the bar being made of

round wire, its edges are nice and smooth. There is a good broad bearing for soldering, and this can easily be made better still by filing the under side of it flat. If there is not room enough for it, some modification can easily be made, such as only curling the ends of one of the two outer wires.

If it is not strong enough you can use more than one additional wire between those with the curled ends, or, of course, a strip of rather thick sheet may be used alone in place of wire.

The hook could also be made on the same sort of principle as the loops, but it would be a rather difficult thing to construct of wire, and it will be more easily made of sheet. This, however, must be fairly thick, say, No. 12 M.G.

If the clasp is a double one, it may often be quite sufficient to provide the two parts with a plain wire hook and loop respectively. This form of clasp is clearly shown in Fig. 128, p. 323. It will be noticed that in the larger of the two clasps in that illustration holes are provided in pairs for sewing each half of the clasp on to one side of the cloak or belt, while the smaller clasp has a series of holes round its edges for the same purpose.

CHAPTER XXXVI

FASTENINGS FOR BROOCHES AND NECKLETS

To make a brooch pin (or tongue) and joint properly requires a fair amount of skill and experience. It is certainly a job that any jeweller ought to be able to do, but like many other equally important items in this craft, and for the reasons which are given below, it is not described in detail in what is, after all, not so much a handbook on the *whole* craft of jewellery, as on certain aspects of it which it is convenient to include under the title "Unit Jewellery."

Brooch pins and joints have to be made economically, that is to say, in large numbers at a time, because no one expects to be charged more than a trifling sum for that part of the work, and if made singly they would be too expensive, so that many jewellers buy them ready made, except when doing high-class work. It would be premature to attempt to make your own brooch pins at this stage, and it would involve a serious interruption in the course of the first exercises recommended. Information is given elsewhere (see p. 209) as to where to obtain instruction about all those branches of the jeweller's craft, which in these pages are either wholly omitted or else are only dealt with in quite a sketchy way.

Strong well-made brooch pins and joints (Fig. 83, A and B) can be bought from any good dealer in jewellers' requirements, but they will generally need a little careful and neat fitting after you get them before they are ready for use.

When selecting them see that the bore of the joint (that is, the small hole in which the wire pin will fit) is of the same size in both of its parts; never buy cheap ones; and remember to get at the same time a steel broach (Fig. 83, C) for reaming out the holes into which the joint-wire fits to form the pivot of the hinge (B), in case this should be necessary, so as to prevent any wobbling of the tongue.

Catches for holding the pointed ends of the brooch pins are also sold, but as these are nothing more than a curl of wire soldered to a small plate, you will have no difficulty in making your own. And Fig. 84 shows an efficient form of catch which is fairly simple to make, and it has the advantage of being constructed out of a single piece of wire. As that

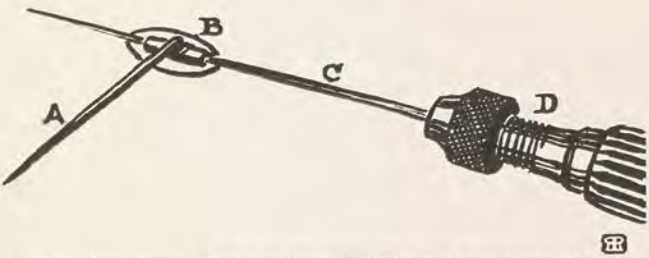


FIG. 83.—Reaming the hole in the joint (B) of a brooch pin (A) with a steel broach (C), which is held in the pin tongs, or tool holder (D).

part of the wire which forms the hook is bent in a direction at right angles to that in which the two ends are scrolled, it is best to use square wire, so that all the bending and scrolling may be as easy as is possible.

If you have no "square" drawplate, that does not matter, because it is quite easy to hammer a short length of wire nearly enough square.

If it happens to be convenient to curl the middle part round to form the hook *after* the two scrolled ends have been soldered to the back of the brooch, so much the better, because then you will gain the advantage of leaving your hook nice and hard, whereas if you had bent it *before* soldering it would be left soft. But you must consider first whether, if you do the soldering first, you will be able to do

the bending afterwards without running much risk of damaging the brooch itself in the process.

The diagram at the top of Fig. 84 shows how this job ought to look after the ends have been scrolled round, but before the middle part has been bent to form the hook or catch.

In constructing hair ornaments it is usual to connect the ornament with the hairpin which carries it by means of a small hinge joint, so as to allow the ornament to rest against the hair at whatever angle with the pin the wearer may desire. So here, again, you are up against a difficult and troublesome little job, which is likely enough to be beyond your present capacity to execute, and the remarks about joints and tongues for brooches apply equally well here. If, therefore, you want to make a hair ornament, you had better buy from a jewellers' dealer a hairpin with a joint suitable for carrying the ornament which you intend to use, and examine how it is made, so as to learn as much as you can against the time when you may want to make the whole thing for yourself.

FIG. 84.—A catch for a brooch pin.

The same thing applies to snaps for necklaces and chains, although there is here no question of a hinge joint.

But for simple, unpretending bits of unit jewellery there is no need to provide anything very special in the way of a catch or snap, and it will be time enough for you to learn how to make them for yourself when you have had a little more practice in fitting and soldering, and when you are engaged upon some rather ambitious piece of work. If, when you have bought a snap, you feel that you could make it all right yourself, then so much the better. Snaps are easier to make than joints, but still they are rather troublesome, and for inexpensive unit jewellery it is doubtful whether it is worth while spending the amount of time that is necessary to make your own when you can buy what you want for a very small sum.

The author now feels that common honesty requires him to own up and to admit that the snaps used for the chains illustrated on pp. 10, 15, 201 and 265 were all "bought" ones. It will be noticed that those used in two of these examples have a little ornament of units soldered on to one side.

These snaps seemed to be good enough for the job, and the time that would have been expended in making special ones was badly wanted for making parts which are *not* sold by the dealers. However, every one must decide for himself how far he will permit himself to include in his work parts which he has not made himself.

From that point of view, however, there is no necessity for a neck chain to have its ends joined together by means of a *snap*. A long "S" hook at one end and a plain loop or eye at the other end will do. But it is astonishing how often the hook type of fastening will contrive to work itself loose. Consequently, if you use them, you had better take care to make them, not only with a long, deep-pocketed hook, but also with the hook well closed in at its neck. See also p. 196.

CHAPTER XXXVII

MORE ABOUT FASTENINGS

ANOTHER kind of fastening for chains and necklaces is the ring and toggle type (Fig. 85).

This is a very safe kind of fastening, but, like most other good things, it has its own particular drawbacks and limitations, and in this case one of these happens to be rather a nuisance to the unit jeweller. In order to undo it, the chain must be capable of being drawn through the ring far enough to allow the toggle, or bar, to come into a position parallel

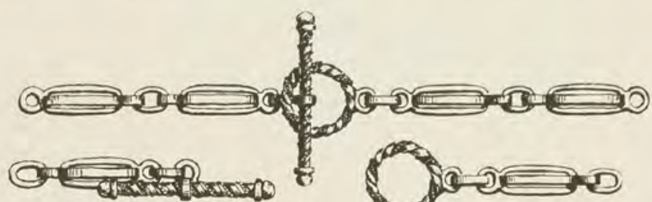


FIG. 85.—Ring and toggle fastening (closed and open).

with the chain, so that it may be able to pass out through the ring endways, as shown in the sketch.

Consequently, for several of the chains shown in Figs. 74 and 75 an absurdly large ring would be necessary in order to allow both chain and toggle to pass through, or else a short connecting length of disproportionately small chain would have to be added, and that would inevitably spoil the whole general effect.

A modification (or perhaps it would be more exact to describe it as an elaboration) of the ring and toggle idea can be made as a disc, to the back of which is soldered a bar or loop connection to one end of the neck chain, while to the other end of the chain is attached a corresponding circular

plate, which has a transverse slot cut through it, and a rim or frame which surrounds and stands up a little above the surface of the plate.

The slot allows *just* enough space for the disc to pass through edgeways, and the rim (which in this case takes the form of an ornamental wreath of twisted wire) is only *just* large enough to allow of the disc being pressed down until it lies flat upon the plate.

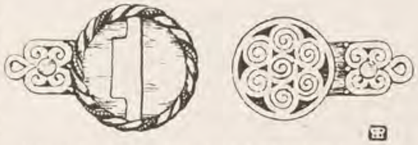


FIG. 86.—Disc and slot fastening (open).

This is a nice, compact and efficient type of fastening, and it may very well be in perfect keeping with a chain composed of units, since the fastening itself, even if it is not actually constructed out of them, may at all events be decorated with units quite properly. But—[oh, yes,

FIG. 87.—Disc and slot fastening (closed).

certainly it has its "but," like the rest of them!]—in order to *be* safe and to look well it does require pretty skilful and accurate workmanship, for unless the two parts of it fit together very nicely indeed it is quite likely to come undone of itself when nobody wants it to do so, except, perhaps, one of the light-fingered fraternity. Also, it takes a lot of time to make. Figs. 85 and 87 are both suitable for making on a larger scale as cape and cloak clasps.

When soldering joints, catches, snaps, etc., into their place, if these have been constructed out of several parts soldered together, then great care must be taken not to let the previous solderings come undone or "started." If this should happen, it will probably be either from overheating or else from forgetting to protect the previously

soldered parts. It is generally enough to paint these parts over with rather thick borax water, so that, when dried, the old soldered joints show white all over. The old solder will then flush again with very little danger of the parts moving.

One other caution must be given here, and that is in regard to soldering the links by which the two parts of a snap are attached to a chain or necklace.

A very small jet of flame must be used for this, and more especially so in the case of the spring part of the snap. This spring depends for its elasticity on the hardness of the silver, and if you allow it to get hot, it will be softened.

To avoid this, proceed as follows :—

Fix the chain and snap by means of ordinary needles stuck into the charcoal block through the links, or else by slipping the links over projecting ends of wire drawn up out of the soldering wig,* if you are using one.

It will now be easy to keep the connecting link quite steady in any desired position while its opening is being soldered. By using a *very* small jet of flame, and by *just* touching the opening of the link which has to be soldered with the *inner* tongue of flame *for a mere second*, it is generally possible to effect the soldering without heating the spring of the snap, especially by being careful to point the blowpipe flame against the link to be soldered in such a way as to direct the heat *away* from the snap.

Still, you must remember that, if you allow that very hot tongue of inner flame to touch the wire more than just for the merest instant, it will almost certainly cause not only the solder, but also the wire, to melt.

If you feel doubtful of being able to do it that way, then wrap the snap closely round and round many times with wet tissue paper and apply a few drops of water to the wet paper just before applying the blowpipe flame to the link

* A soldering wig (see p. 33) is a rather closely-matted pad made of thin iron wire bound to a rough frame of stronger wire, some of which is twisted together to form a handle. A piece of work which has to be soldered or annealed can be either laid upon the wig, or bound to it, or even, if small, it may be embedded in the wig. During the process of soldering the parts of the wig around the work get red hot and so facilitate the soldering.

which has to be soldered, and if you should fail to make the solder run quickly, then keep on damping the tissue paper if it shows any signs of getting dry.

Sometimes, when one part has to be carefully protected while an adjoining part is being heated, the best plan is to bury the part which is to be kept cool in damp moulders' sand. Any sufficiently fine sand would do, but moulders' sand holds together very firmly when damped, and remains in the same position after the moisture has evaporated, and at times that is a great convenience.

A Postscript to Chapter XXXVII

It was not until after pp. 190—195 had been written that the development and construction of the various patterns of chain which were illustrated in Chapter XXVI. helped to suggest some further ideas for fastenings which are suitable for neck chains and wristlets, especially if the chains which have to be fastened happen to be of patterns such as Figs. 54 to 62.

Fig. 87A represents a double hook fastener, the two parts of which are really only two elongated links of the Fig. 54 pattern of chain, except that the terminal hooks are bent into a sort of keyhole shape, which lessens any tendency that they may have to come loose accidentally. This keyhole shape also makes it easier to hook them together than might otherwise be the case.


Fig. 87A.—A double hook fastener.

That is due partly to the fact that the hooks are of such a length as to make it easy for them to be held firmly between the fingers, and partly, also, to the fact that the loops can be made big enough to allow the scrolled ends of the hooks to pass through them without difficulty. This type of fastening can quite well be used with any of the chains which are shown in Figs. 54 to 57.

For some of the others, such as Fig. 61, a broader fastening is desirable. Fig. 87B meets the case very well, and it has the great advantage of being very unlikely ever to come undone of its own accord, besides which it is not quite so difficult to make as might be supposed, though it certainly requires to be made with care and accuracy.

A clear understanding of the way in which it is formed should be arrived at by examining Fig. 87C, in which the two

loops are shown as they appear when they are separated, and then by observing that  expresses the shape in which each of the two parts of the fastening appears after the loops at its two ends have been made, but before the middle part of the wire has been bent round to provide the main loop.

As this last part of the bending has to be done "edge-

FIG. 87B.—A double loop fastener (closed).

FIG. 87C.—A double loop fastener (open).

ways," it is desirable to use for that process the special kind of pliers which are commonly described as "half-round and flat." The half-round part of the pliers imparts a smooth and even curve to the inner edge of the loop, while, in consequence of the other surface of the pliers being flat, you can grip the outer curve of the loop firmly without any danger of bruising the wire. If you used ordinary round-nosed pliers for curving it edgeways the outer edge of the wire would be sure to get badly marked.

Another fastening which is very similar to the one which

has just been described, though, perhaps, it is not quite so neat looking, can be made without any of this rather difficult edgeways bending of the wire; but then, after completing the first bending process by which the small loops at the two ends are formed, two of these small loops must be bent up at

FIG. 87D.—An alternative form of double loop fastener (open).

right angles to the others, and then, when a large loop is formed by bringing the ends together, the general appearance will be as indicated in Fig. 87D. In this illustration, however, the two long, straight links which are shown at either end of

the clasp are, of course, made quite separately, and they do not necessarily go with it.

They are included in the drawing in order to demonstrate the appropriateness of this particular kind of fastening for use with a chain in which long, straight links occur in pairs.

In just the same way Figs. 87B and 87C each include two links of another type of chain for which the fastening that they illustrate is suitable.

The appearance of Fig. 87D when the loops are clasped together is illustrated in Fig. 87E, and an examination of this drawing and of Fig. 87B will show that in each case the large loops are gripped tightly in the closed position by the spring of the small loops between which they are tucked in such a way that an appreciable amount of force must be exerted in order to separate the loops and open the clasp. Consequently, these fastenings are not at all liable to come open of themselves. This method of forming twin pairs of small loops to act as a spring for keeping the fastening securely closed is the invention of C. J. C. Baker.

FIG. 87E.—The second form of double loop fastener (closed).

Either of these two last designs might very well be carried out on a larger scale as clasps for cloaks or for waist-belts.

Other patterns of chain which are formed on the principle of making the construction come *before* the soldering will generally provide an appropriate fastening by some modification or elaboration of one or other of the links out of which the chain itself has been built up.

NOTE.—With regard to the clasps illustrated in Figs. 87B to 87E, it is important to realise that it is *not* a matter of indifference which of the two end loops is threaded through the other one. One of the two *must* be slightly wider than the other one, and it is the *wider* of the two loops which has to be threaded through the *narrower* one.

CHAPTER XXXVIII

INVISIBLE STIFFENING RIBS

It will sometimes happen that when you have finished a piece of work up to the point when it is ready for polishing, you will become aware that it needs some further strengthening, over and above what it has already gained by the addition of the various enrichments which have been put in to improve and to complete the design.

This way of looking at the matter is perhaps peculiar to unit jewellery, one essential part of which consists in allowing design and construction to act and react upon each other mutually all the time, so that something in the nature of an organic growth or structure may gradually develop as the work progresses.

A hostile critic would probably condemn this method in the most uncompromising terms, saying that it was utterly wrong, both in root and branch ; that it meant leaving both design and construction to the mercy of the chapter of accidents ; that it was an admirable way of encouraging beginners to try and run before they could walk ; and that the idea of waiting until everything else except the polishing had been done, before considering whether an object was going to be strong enough to hold together, was an almost incredibly glaring example of putting the cart before the horse, and so forth and so on.

Well, no doubt all that *may* be so, and in any case, on this, as on most other occasions, there is probably a good

deal to be said on both sides, and perhaps the wise craftsman will endeavour to find a middle course.

For example, when you have got a skeleton arrangement which you have built up out of a number of units, for a start, and you have perhaps pretty well decided to associate certain other groups of units with this skeleton, you will then be likely to try the effect of various other additions and enrichments, such as clusters of grains, domes, twisted and beaded wires, and precious stones. Now that is probably the best time for considering how far these proposed additions and enrichments are likely to increase or to diminish the strength and rigidity of the whole thing when it is completed.

One of the beauties of unit jewellery consists in the interesting *spaces* which so often occur either within or between the lines of the individual units—a point which attracts our attention in nearly all unit designs. Sometimes these spaces will appear dark in contrast to the surface of the silver which encloses them, sometimes the reverse will happen.

Occasionally they are so small that they tell in the general effect simply as so many specks of dark shadow, and then it may not matter at all what comes behind, but more frequently it will happen that whatever may be the shape of these spaces, it is of the utmost importance that there should be *no* accidental lines crossing them at the back. This means that in the case of unit jewellery it may very likely be rather difficult to find a place for a constructive framework (if it does not form a part of the design) in such a way that it will not show.

Let us consider this problem in special relation to Fig. 88. In this instance the design did not seem to need that its lines should be either emphasised or interrupted, and the units out of which it was built up seemed to have in themselves enough variety and richness to be left without other additions than some precious stones, mostly very small, and a few isolated grains and discs.

In such a case, however, it becomes necessary to make

other additions behind, in order to supply that strength and stiffness, without which such an ornament would be unable to resist the strain of ordinary wear and tear ; but these,

Fig. 88.—Silver pendant and chain built up out of units.

important as they are constructively, have nothing to do with the design, and are, in fact, invisible from the front. The collets in which the stones are set, as also the discs and

grains which cover or fill in some of the joints, all help to stiffen and strengthen the constructions, but they are not enough by themselves.

It was mainly the wreath part of the pendant which required some additional stiffening in this instance (Fig. 88). In cases of this kind it is well to solder on a light ring of either flat or round wire behind the wreath, if that can be managed. Even if the ring is very slender indeed it will add quite appreciably to the strength of the wreath, provided that both are securely held together by neat soldering around the entire circumference of the ring.

If it should unfortunately happen that small parts of the wire ring are visible from the front, here and there, through the openings in the wreath, then by the judicious application of a needle-file it will often be found possible to remove the parts which show through, without actually severing, or too greatly weakening, the ring. A sharp scorper of suitable shape will often do a job of that kind better and quicker and more neatly than a file, *if* you have had sufficient experience in the use of these tools, but in the hands of a novice they may easily do a lot of damage in a very short time, so it is generally wiser for a beginner to use a file.

If there is no space at all for a concealed ring of wire behind a wreath, then if strengthening is necessary, it must be done by soldering detached bits of wire on to such parts of the back as will admit of this.

If you examine Fig. 88 rather closely you will no doubt observe that the six *sides* of the hexagonal figure which forms the wreath do really look quite strong in themselves, and that even if that appearance had been deceptive for some reason or other, there would have been no difficulty in adding an invisible strengthening rib behind, because the four units, which are laid back to back and end to end to form the repeat of the design, provide plenty of cover; the only space which would otherwise have caused a difficulty being entirely concealed by the small stone and its setting which decorates the centre of each of these straight parts.

The same wreath which was used for the pendant in

Fig. 88 also appears in the middle of Fig. 79, and there it is shown just as it looked before either settings for stones or any grains or discs had been added. These things were afterwards put in so that they might help to complete the wreath form of the design, and to bind its parts more securely together.

It now becomes quite evident that the weak part of the construction is at the corners, and that, after all, is only what we should expect. And now that our attention is directed to the corners, we see at once that the weakness here is by no means only in the construction, but quite equally so in the matter of design.

These corners look, to put it as kindly as we can, ineffective, and it seems to be a fairly reasonable inference that if the corners had been better designed, so as to have been more efficient from a decorative point of view, they would have been more efficient from the point of view of construction also.

Anyhow, if they had been considered more carefully at first, the formation which in this case was used would have been rejected as unsuitable, and it would have been replaced by some alternative arrangement, which, while offering enough conveniently placed soldering points to give constructive security, would also have allowed cover for any stiffening rib that might be thought desirable.

In a formation of this kind lightness of appearance, and lightness in actual weight, may be so essential to the success of the work, that it may be permissible to "sail rather near to the wind" as regards strength and rigidity, with the mental reservation that when all is ready for polishing, it will still be possible to add some light stiffening ribs at the back if the "feel" of the thing suggests that it will be wiser to do so.

On a few quite rare occasions, especially when it is a case of some very delicate and light ornament in gold, it may perhaps be found expedient to solder the whole assemblage of units upon a piece of very thin sheet as a back plate, subsequently cutting away every part of this same back plate wherever it can possibly be seen from in front.

By that method all the parts are much more firmly united than when they are only soldered to one another at their points of contact, but the whole operation is likely to be a pretty ticklish job, and one which would only be tolerable when it was very perfectly executed, and in the first place the soldering would need to be absolutely flawless. The back plate method is more applicable to the repairing of delicate pieces of old work than to the construction of something new. Nevertheless, it may be permissible occasionally, though if your design is of a decidedly gossamer type, you will more probably give it the necessary degree of strength by using a specially prepared wire. This may look as thin as you wish when seen from immediately in front, so long as it makes up for that by its comparatively great depth from back to front.

If you have no drawplate which will give you this tape-like section, then you must either pass some wire through a flatting mill until it is thin enough,* or failing that, you must hammer it out on a flat stake. The latter process is not so slow as it sounds, nor is it difficult to regulate the blows of the hammer so that the stretching may be done almost as evenly as in a flatting mill.

Whichever way you do it, the wire will probably need straightening afterwards. Anneal it after flattening, then grip one end in the vice and pull the other end gently but steadily until you feel the wire *give*. It will then be perfectly straight.

* Or use swage and dies. See p. xxxii.

CHAPTER XXXIX

POLISHING JEWELLERY

In order to give a piece of light jewellery work adequate support and protection during the process of polishing, it is sometimes a help to fix the job down to a bit of wood, by means of a few gimp pins, or cobblers' brads, and the heads of these can be cut off with nippers if they project inconveniently.

This recommendation applies more perhaps to chain than to brooches and such like small things, and of course it is open to the objection that the job has got to be released and refixed several times over to get at all sides of it during each process of polishing, but I have found it useful.

The number of processes necessary will vary according to the smoothness or roughness of surface of the parts and according to the kind of finish desired.

Unit jewellery made according to the instructions given in this treatise will have a nice smooth surface in consequence of the setting or planishing with a polished hammer on a smooth and polished steel stake (see p. 126), and this planished surface readily takes a good polish without much preparation. But if the surface of either hammer or stake was not clean and brightly polished, there will be marks in the surface of the silver which must be ground out.

The same thing applies to marks caused by over-exposure to heat, or by untidy soldering, which latter has had to be cleaned up by filing or scraping and so forth. In any case, the first process will be to boil the work out in pickle, after which it must be very thoroughly rinsed in clean boiling water and then dried, preferably in hot boxwood sawdust.

If there are any ugly marks such as those described just above which have got to be ground out, then brush the work with a stiff bristle brush, shaped like a very large tooth brush, using a mixture of powdered pumice and rather thin lubricating oil. For any parts which cannot be got at with the brush use either polishing " threads " or else bits of wood, applying the pumice and oil at the same time.

Remember that pumice grinds silver away rather quickly, and so if there are any enrichments of fine beaded or twisted wire on your work, take great care not to scour those parts much, or they will be ground smooth. When the surface of the work is evenly covered with fine scratches made by the pumice, wash it thoroughly, first with paraffin and afterwards with petrol, using a brush such as painters use, so as to make sure of washing away all particles of pumice. It is not actually necessary to use paraffin first, but it saves the petrol only to use it when most of the dirt has been removed. The same petrol can be used over and over again, as almost all the dirt will settle to the bottom, but owing to its highly inflammable nature it should never be used in the same room with any flame or fire or stove.

Now put away the pumice and any brushes, threads and stocks which have been used with it, and keep all these things in a box or drawer by themselves.

See that there is no pumice grit left on your hands, and then, with a mixture of crocus and oil, or of rottenstone and oil, repeat the process, and keep the brushes, threads, etc., used with crocus or rottenstone in another box or drawer reserved for them only. The effect of this second process should be to remove all the scratches made by the pumice and to leave a smooth and even, but dull surface. When there are no marks which have to be ground out, no scouring with pumice is necessary.

After every trace of crocus or rottenstone and oil has been washed off with petrol, dry the work in boxwood saw-dust, and (with clean hands) finish by brushing with a thin paste of jewellers' rouge and water. The work should now

have a brilliant polish. Wash it in very hot soapsuds and keep on brushing (with a clean brush) and rinsing in clean hot water until there is no trace of rouge left and the water remains colourless.

Finally, dry the work in hot boxwood dust, using a clean dry brush to remove the dust.

The effect of the preliminary cleaning process of boiling out in pickle will have been that if there are any parts which have not been reached by the various stages in the process of polishing they will remain a pearly white colour. There will almost always be such parts, and the effect will be spotty and unpleasant. If in spite of the recommendations which follow after this sentence you desire to produce an even bright polish over the whole surface, then the white specks must be scrubbed with pointed bits of "pegwood," at each stage of the polishing, with due care to use always a clean bit of pegwood for each separate stage. Even if there are no actual white spots, the lines of the design would show up better and the general appearance would be more restful and pleasant if the narrow crevices were darker and less highly polished than the general surface.

This result comes about in course of time as a natural consequence of the action of impurities in the air. These impurities gradually darken the sunken parts which escape contact with the polishing cloth or brush, and the ornament looks richer in consequence.

However, it is a longish time before this happens, and the surface of silver is quickly and easily darkened by the application of a solution of sulphate of potash in water, applied hot.

But be careful not to overdo this process. If you plunge a piece of silver work into this hot staining solution it will almost instantly turn black all over, and it may be quite a long and tedious job to polish this black stain off from those parts where it is not wanted, besides which, a better effect is obtained with a paler colour.

It is wiser, therefore, to use a weak solution, not too hot, to apply it gradually to one part of the work at a time, and

then, if the action of the chemical is too slow, quicken it by a judicious application of heat to the silver, and, if necessary, by a second application of the solution applied with a water-colour brush, locally if you like.

While doing this, have a bit of chamois leather close by you, which is well impregnated with rouge, in at least one place, and then, if the discoloration of the silver is progressing too rapidly or extending too far, dip the object into clean hot water immediately, give it a rub with the rougey leather, and all will be well.

This darkening process is often called oxidising, but how that term came to be applied to what would be more correctly described as sulphurising is not clear.

In work which includes the use of precious stones each individual "setting" should have a preliminary course of polishing before it is soldered into its place. It is much easier to polish the settings thoroughly while they are loose, and then, after they have all been soldered in their proper positions, all the various processes of cleaning, polishing and finishing the other parts of the work should be completed before the stones are actually set, after which nothing more ought to be needed than a final rub with a clean leather or selvyt cloth.

CHAPTER XL

STONES AND SETTINGS

THERE are many different ways in which precious stones may be mounted, and most of them are quite beyond the scope of this book which aims especially at giving an analysis of what is, perhaps, a new and certainly a very easy method of designing a simple kind of jewellery.

It also aims at explaining the best ways of tackling such processes as are necessary to the practice of this method of designing, and to the making of the ornaments which are thereby suggested.

If it happens that you are within reach of a good technical school or of one of the schools of art where jewellery work is well taught, the personal help which you would get there in acquiring a knowledge of stone-setting and of several other branches of jewellery work which you ought to understand would be of great value.

Also, you should study "Silverwork and Jewellery," by H. Wilson, in The Artistic Crafts Series of technical handbooks. It is a most inspiring book, full of suggestive information, the work of a great Master.

There is another good book called "Metalwork and Enamelling," by H. Maryon, from which, too, you can get a lot of practical help in considerable detail, and it includes several useful chapters dealing with various methods of setting stones.

If you can't afford to buy these books, you may probably be able to borrow or, at any rate, to consult them at a reference library.

But in the meantime we will suppose that you have got, or else that you have decided that you will get, a few precious

or semi-precious stones, and that you want to set them like those which appear in the illustrations on pp. 10, 15, 162 and 201. To begin with, at all events, it will be best to limit yourself to "cabochon-cut" roundels and ovals and to see that their under sides are flat, so as to make the process of setting as easy as may be at first. "Cabochon cut" means that the top of the stone is of a smoothly-curved convex shape, like the top of a man's head—the word "*caboche*" being the French equivalent of the old English word "*pate*," that is to say, the crown of the head. Strictly speaking, a "cut" stone means a facetted one—a stone which is covered all over with a network of small surfaces or facets, all of which are ground quite flat and smooth, and are then highly polished.

The main principle of most of the methods by which stones are set is that the under side of the stone rests on a ledge or on the shoulders of a number of small projecting pieces, and that it is kept in position either by a collar of metal standing up from the ledge fitting closely round the stone and pressing it home as a result of the top edge of the collar being contracted—and this is called a plain collet setting; or else the small projecting pieces stand up in a similar way around and slightly above the stone, and their tips are then bent down until they press firmly on it, in which case it is called a coronet or claw setting. These methods are capable of many interesting variations and elaborations, and they often form important features in the whole design.

But a plain, round collet setting is the easiest kind to begin upon, and that kind of setting is more suitable for holding cabochon-cut stones than for facetted ones, which generally look best in coronet or claw settings.

The collar of metal which stands up all round above the ledge on which the stone rests will naturally vary in thickness according to the size of the stone which it will have to hold in position.

An experienced jeweller, who will start to work upon a fairly thick collet first with a flat scorper and then with a "bull-sticker," will very quickly cut away enough metal

around its inner part to provide a ledge for the stone to rest on, but beginners will find it much easier to make the collet of two separate pieces—a thin outer band made to fit closely round the stone, and a rather thicker band to form the ledge, *just* small enough to be pushed inside of the thin one, to which it must be well soldered.

There is a special advantage in this method in the fact that " fine " silver may be used for the outer band.

Fine * or pure, unalloyed silver is much softer than standard (or sterling) silver—too soft, in fact, for any object which is exposed to ordinary wear—and that is why standard silver contains a small proportion of copper ; a proportion, however, which is just large enough to make standard silver about as hard as brass without altering the colour of the silver.

But when once a thin collar of fine silver has been rubbed close down on to a stone, this rubbing has so hardened it that it is quite strong enough to hold the stone securely in its setting, and it will also resist any wear to which it is likely to be exposed.

The actual pressure which is needed to close the rim of fine silver down on to the stone and to rub it quite smooth and even being considerable, and one consequence and object of this rubbing being to make the top edge of this rim project inwards over the edge of the stone everywhere to an appreciable degree, it is obvious that the stone cannot easily be forced out from under it.

* In order to determine whether any piece of silver is " *fine* " or not, cut off a minute fragment, and melt it into a grain and allow it to cool. If it is then pearly-white in colour, that proves that it is pure or " fine " silver. If it is standard or " sterling " silver, it will have become nearly black through being melted, but this colour is merely surface oxidation, and immersion in boiling pickle will whiten it at once. A further proof of fine silver will be in the form of the grain, which will be irregular and by no means perfectly spherical. Also it will take appreciably longer to solidify than standard silver. A very tiny fragment, even a few scrapings or filings, will suffice for this test.

CHAPTER XLI

THE CHOICE OF STONES

A CLOSE examination of the pendants illustrated on pages 15 and 201 will show that some very small stones—stones that were, in fact, no larger than moderate-sized grains, were used here.

These were pale rubies and sapphires, which, partly because of their smallness and partly because of their pale colour, were quite moderate in price.

Even when pale in colour there is a certain brilliant quality in these stones, in consequence of which they certainly told with good effect in the designs, but, owing to their minuteness, they were not very easy to set, and they would probably cause much trouble to a beginner. The largest stones used in either of these pendants were no more than $\frac{1}{4}$ inch in diameter, and even that is rather small for a first attempt at stone setting.

It will be prudent, therefore, to begin with a round, cabochon-cut, flat-bottomed stone, measuring nearly as much as $\frac{1}{2}$ inch across. Naturally, this can only be semi-precious, but it should be hard and tough, so as not to be easily scratched or chipped. There is considerable danger of damage in one or other of those ways, or even in both of them, with many of the stones which are commonly used.

One rather hesitates to recommend *stained chalcedony*, because of its artificiality, but so long as it does not pretend to be something which it is not, such as an emerald or a ruby, there is much to be said for it. Chalcedony is not too easily chipped or scratched; it is not expensive, and, when well stained, it is very pretty. It is a variety of *quartz*.

The natural structure of this stone often gives beautiful gradations in the depth of the colour when it is stained, and if one of the dull green, or quiet grey-blue, or opalescent mauvy colours is chosen, you cannot be accused of trying to pass off a cheap imitation as something precious. Ordinary white chalcedony, unstained, is not interesting, but there is a pale pink kind which is rather nice.

Jade is very hard and tough, and fairly moderate in price, but the dark green Australian kind looks lifeless unless it is well " concaved " (*i.e.*, ground hollow underneath), and that comes expensive. The white kind is ineffective.

Green serpentine is rather soft, but it is not specially liable to chip, and it is comparatively cheap. In colour it is like the flesh of a greengage, but of a somewhat richer green, more luminous and more transparent, but frequently marred by black specks, which are sometimes, but not always, quite tiny.

Amazon stone is one of the prettiest of the cheaper stones, and it harmonises particularly well with silver. It is of a cool bluey-green colour, which is not easy to describe, unless by saying that it is rather like the colour of a hedge-sparrow's egg, but somewhat greener ; or by comparing it to a very green sea in the wake of a steamer which has churned the water into foam through which streaks of darker green show here and there. The formation of the stone is fibrous or scaly, so that it is full of tiny streaks or patches of varying shades of colour, and sometimes there is an effect as of a minute network of white light imprisoned within the stone, while at other times the darker bits of colour are separated by a more opaque whitey-green background. Unfortunately, it is decidedly brittle, and the larger pieces are very liable to have cracks, so that due care must be taken, when fitting collets and so forth, to avoid chipping the edges of Amazon stones.

Pearl blisters are useful and effective—perhaps one of the most effective of the cheaper " stones "—though the term stone seems hardly appropriate to what is, after all, only part of an oyster shell.

But they are apt to be irregular in shape, and although that is an advantage for some kinds of work, it is rather the other way with unit jewellery, which is generally built up on geometric lines, and as an incident in a geometrical design a stone of irregular shape rarely looks really well. Still, for designs which are constructed on an oval formation, and for designs, too, which require a large, important-looking stone, a pearl blister may often be just the right thing.

The actual setting is sometimes a bit troublesome on account of the irregular modelling of the stone, because this must be followed by a corresponding shaping of the collet edge. In choosing pearl blisters, the bulgy ones should be picked out. If pearl blisters are flattish on the top, the effect is nearly always poor.

Red coral is another effective " stone " of moderate price which might well be used oftener than it is for simple, unpretending little ornaments.

Opal matrix and " mounted " opal can sometimes be got on fairly reasonable terms, and, when good, there are few things to equal them in beauty. Matrix is the term used to express the rock in which the gem is found. Gem opals are those from which all the rock in which they were once enclosed has been cut away. That process often has the result of robbing the stone of a large part of its beauty.

Gem opals are generally half transparent, and in order to see the wonderful colours of the stone when that is the case the stone must be placed on a dark background, as proved by the regular custom of displaying opals on black paper.

But a dark background is precisely what nature provides in the matrix, and now it is not uncommon for a thin slice of gem opal to be artificially mounted on a piece of the native rock. This is an economical way of making the most of the precious part of the stone, and, when well done, is perfectly satisfactory and, generally speaking, much cheaper than a good piece of " matrix " of equal size, curious as that may seem, especially as the thin slicing and subsequent mounting of this exceedingly brittle stone must be a delicate and risky operation.

Turquoise and *turquoise matrix* look well with silver, and small pieces are inexpensive, especially if there is no objection to the less sought after greeny-blue colour, which, to my thinking, is often more beautiful than the even bright blue, which fetches the higher price.

Blue moonstones are among the most beautiful of stones for use in silver settings. When buying them it will be well to avoid those which have no definite edge or " girdle " upon which the stone will rest in its settings. These stones are often shaped with thick, rounded edges, and in that form they are difficult to set. Not expensive.

The white variety is wanting in interest, except when of really fine quality and corresponding price.

Lapis-lazuli or, as it is usually abbreviated, *lapis*, with its rich deep blue colour, tones well with " oxidised " silver, and is suitable for the less delicate kind of ornaments, but as it is quite opaque it is not appropriate to anything that tends towards the spidery, and it does not light up well or show its colour to advantage by artificial light.

Labradorite is a stone which makes a strong appeal to a few discerning people, but it is not by any means everybody's stone. In many lights it looks like a plain grey pebble. Then as the wearer turns there will be a vivid gleam of blue, sometimes pale, while in other pieces it will be of deep gentian colour, or, again, of pale green, but always luminous. Although in many ways very different, Labradorite has much in common with moonstone—the same changing translucent iridescence. Both stones are varieties of feldspar.

Chrysoprase is a fine variety of *chalcedony*, and good specimens are of a lovely translucent caterpillar green. It is a hard stone, and it is not over brittle. Not expensive.

Amethyst is a violet or purple variety of transparent *quartz*. A rare and much more brilliant kind (oriental amethyst) is akin to the ruby. The origin of the name is interesting. It is a Greek word, of which the nearest English equivalent seems to be the somewhat unromantic word—teetotal. The less rare kinds are not expensive.

Ceylon stone is rather an indefinite description, but it is

commonly understood to include the semi-precious, variously coloured, hard, translucent crystals which are found in Ceylon, and they may be of almost any shade of red, blue, green, yellow, brown, and even black. Yellow and smoky ones are called *jargoons*. [Not expensive.] A finer and more precious variety is very like a ruby and is called *spinel*.

Garnet is a hard transparent stone generally (but not always) of a deep red colour, and fine specimens have a glowing fire-like quality. When these stones are "cabochon-cut" they are sometimes called *carbuncles*. Not expensive.

Topaz is generally pale yellow in colour. It is a brilliant transparent stone, rather harder than *quartz*.

Tourmaline is in appearance similar to Ceylon stone, and, like the latter, has many varieties, both in colour and quality.

The best varieties are bright, transparent and clear in colour, in which latter respect the most characteristic shades are perhaps "old rose" with a good deal of blue in it (just about the colour of pink Japanese anemones), moss green, and a soft greeny-grey-blue, very like the colour you see as you look at the cut or broken edge of a pane of glass.

Pale *rubies* and *sapphires* of small size are not excessively expensive, and when the necessary experience in the trouble-some job of setting small stones has been acquired, their occasional use will be well advised.

Aquamarine, as the name indicates, is a transparent crystal, resembling in colour the water of the sea. It is a variety of *beryl*, and therefore is it related to the *emerald*, but unlike its relative, it is not one of the really costly stones.

CHAPTER XLII

METHODS OF SETTING

WHATEVER kind of stone you may have selected, if it is somewhere near half an inch in diameter, as it should be for a first attempt, then the rim of the setting may be made of fine sheet silver, No. 5, in the metal gauge. Keep the diameter of the rim on the small side, because it is likely to need setting true on a triblet after soldering, and then a few light

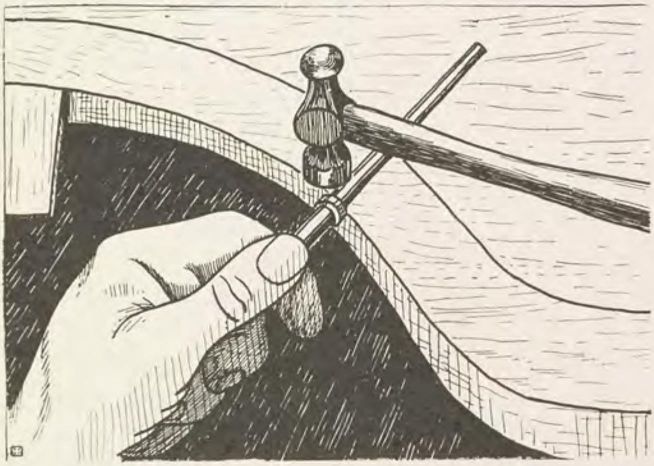


FIG. 89.—Setting a ring true on a triblet.

taps with the hammer will very quickly stretch it until it fits the stone nicely.

When the rim and the inner ring which will form the ledge are both soldered and set true, and properly fitted ready for soldering together, see that the two joints do *not* come together.

The rim must be temporarily encircled with an iron

binding wire to prevent the joint from opening while the two rings are being soldered together, and the same precaution will also have been necessary with each ring when its joint was first soldered, to keep the ends in close contact. But do not tighten the iron binding wire *over* much, or it is likely to make an indentation in the surface of the silver. The object of the two loops or kinks is to make it possible to tighten up the wire at three separate places so that the tension may be even all round the collet.

Now that the rim and the inner ring have been soldered together to form the collet there is no danger of the joints opening when the whole is soldered into its final position, so long as the previously made joints are all well coated with borax water, and so long also as the whole thing is not overheated. But first it must be polished (see Chapter XXXIX.).

Fig. 90.—Method of using iron binding wire.

Later on, when you come to use smaller stones, you will find it desirable sometimes to use thinner silver for the rim. For the very small stones [already alluded to] in Figs. 7 and 88, pp. 15 and 201, No. 3 silver would be strong enough. It is quite surprising how much force it takes to press the top edge of the rim close down on to the stone when the rim is in the form of a round or oval tube of such very small diameter as is required for these little stones. And there must be no " shake " whatever—that is to say, each stone must be held down quite rigidly in its setting. For such stones as the larger ones in Figs. 7 and 88, No. 4 silver would be suitable, while for the big stones in Figs. 4 and 71, pp. 10 and 162, No. 5 silver would be necessary.

Before beginning to press the edge of the rim down on to the stone make sure that the amount of it that stands up above the stone is even all round and that the edge is smooth. Then hold the stone down firmly, either with one finger or with a bit of wood, while the rim is pressed in against the stone, first at three of four isolated places round the cir-

cumference and then at the intervening places between them, and so on until it is pretty evenly down everywhere as close to the stone as you can press it.

The bone handle of an old tooth brush filed flat across the end, but not too smooth, will do very well for this first closing down of the rim, and if it is pressed with a slight rocking movement, that will help to get the rim down close on to the surface of the stone, evenly and without puckers.

To hold the stone firmly down on the ledge upon which it rests within the collet, while the rim of the setting is being closed in upon it, if anything more than a finger is needed, a short piece of small bamboo cane is convenient. Being hollow, it can be held firmly on a polished and rounded stone without slipping more easily than a solid stick; but for *very* small stones use a bit of "peg-wood," the end of which has had a slight hollow charred in it by a red-hot nail.

FIG. 91.—Cement stick.

It will often happen that in order to support a delicate piece of jewellery work so firmly as to resist the very considerable pressure which is required to close a setting, without damaging the rest of the work, you will be obliged to embed the whole ornament in jewellers' cement, a most useful material resembling sealing wax. Cement sticks, which are sold for the purpose, are meant to be held in the left hand, as in Fig. 92 (p. 221), and in Fig. 91 there is shown one of these which has been prepared with a sufficient head of cement to accommodate an ornament like the one which is being dealt with in Fig. 92. There are occasions, however, when it is more convenient to have the cement on a small flat block of wood, which may either lie upon a sandbag or else be gripped in the vice—thereby leaving both of your hands free for holding the stone and at the same time closing the setting.

In order to soften a good big lump of jewellers' cement it must be heated rather slowly over the gas, and it must be kept moving all the time—otherwise the surface will be melted and there will be a mess, and most probably burnt fingers. The best way, therefore, is to stick a lump of cement on to the large end of the cement stick by warming both, and then to keep turning the stick about while the cement is being softened over the gas, from time to time pressing it into shape upon the cold steel stake, and finally, when the cement is well warmed through, modelling it with damp thumb and fingers.

The ornament which has to be held should be moistened all over and completely enclosed in gold-beaters' skin, in order to prevent the cement from sticking to the silver and (another important point) to prevent the cement from squeezing its way into the setting; but the gold-beaters' skin must follow the contour of the work, and it must *not* be stretched across gaps, other than settings, or else the cement will not get a sufficient hold. Then, when you think that the cement is soft enough to squeeze into and round the ornament enough to hold it securely, press the two together and, if necessary, work the cement in such a way as to form a barrier all round and slightly overhanging the edge of the ornament. The cement will soon get cold and very hard, and that may be hastened by means of cold water if desired. When it is perfectly hard the gold-beaters' skin is easily removed from any parts that have to be worked on, and when all the work for which the support of the cement was needed has been completely finished, the cement can be split off bit by bit with a scorper, until the ornament is released.

You will probably notice from Fig. 92 that in that case there is *no* barrier of cement around the outside of the ornament. The nature of the object provided such a good "key" for the cement that no barrier was needed—nor was it even necessary to envelop the whole pendant in gold-beaters' skin.

A single piece laid across the back before it was pressed

down on to the soft wax was enough. In this case, as there were no projecting pieces of cement to break away when the setting was finished, the pendant was released by pressing a slender pointed scorper down into the cement between the ribs of the pendant, just enough to chip the surface of the cement in *many* places, until it had completely lost its hold on the ornament. If you attempt to pull away a delicate

FIG. 92.—Method of using a burnisher to close a setting.

piece of work from the cement while it is still held, even if only at one place, you are pretty sure to damage your work, and when the cement is hard it is so brittle that it only requires a little patience to break up its surface everywhere, bit by bit, until all risk of damage to the ornament is eliminated.

Assuming that your ornament is now firmly supported on a cement stick, you will begin with the preliminary closing

down of the rim of the setting as described on pp. 218, 219, and when you have carried that process as far as you can, you must next take a small steel burnisher, the end of which is nicely rounded, highly polished, and shaped like the kernel of an almond (Fig. 93, p. 224); hold it quite short in your right hand, so that while your right thumb presses on the top of the stone (Fig. 92), you can rub the rim of the setting with that part of the burnisher which comes just behind the point. Then wet the burnisher and rub the edge of the setting on to the stone, not using too much pressure at first, but increasing it gradually as you go on, so long as there is no tendency for any puckers or creases to form in the rim.

If any puckers do begin to develop you must at once smooth them out by direct pressure with the flat end of the old tooth-brush handle, and repeat this as often as they show signs of recurring.

The rim should be quite close down on the stone with a smooth bright bevel after you have been round it with the burnisher two or three times. But the top edge of the rim will be improved by a further course of rubbing with the end of the burnisher, frequently wetted, the tool being held nearly horizontal, but with a slight downward slope towards the point which rests against the stone, on the top edge of the collet.

This closing down process is made decidedly easier by using fine silver * for the outer band of the collet instead of standard silver. The quantity of silver required is so very trifling that the additional cost is negligible, and moreover there is a further advantage, which will be explained in the next chapter.

* Or fine gold.

CHAPTER XLIII

HARDENING AND TEMPERING STEEL TOOLS

STEEL burnishers are made in many varieties of shape, but none of the usual patterns seem to be quite suitable for closing settings. Those which are right otherwise are much too long in the shank. Fig. 93 shows a home-made one, and it is drawn without the handle purposely, and in two positions. By comparing this with Fig. 92 you will see that the handle is driven on until only about $\frac{5}{8}$ inch of the burnisher projects. The handle is straight, of the pattern usually sold for burnishers. The tool *must* be made of "tool" steel,* and it should be filed nice and smooth.

It must then be hardened and tempered, and it should not be polished until after hardening because a polished surface is liable to scale very badly when made red hot. Have a jar of cold, or nearly cold water, close to your blowpipe or Bunsen burner, if you have one, and direct the flame against a lump of pumice stone or fire brick, and hold the burnisher in the hottest part of the flame until it changes evenly all over to a moderate cherry-red colour, *not* too bright.

The blowpipe and blower shown on p. 29 will do this, but it would be of no use trying to do it with a mouth blowpipe. When the steel is hot enough lower it down, *vertically*, into the water, and keep it moving about until it is cool.

Now try cautiously with a smooth file (not a new one), and if the file slides over the surface without cutting you

* In order to make quite sure that you have got a piece of "tool" steel (often called "cast" steel), cut off a fragment just big enough to hold between finger and thumb, heat it to a bright red, and plunge it into cool water while it is still bright red. Then test it with an old smooth file (one, however, which has not had all its "cut" worn off), and if the file slips over the steel and will not cut or mark it, then you may be sure that it is "tool" steel. Silver steel is a tool steel of fine quality.

will know that the steel is dead hard. If not, then try again, making it a little hotter than before.

When you are satisfied that it is hard, proceed to polish the rounded part with several different grades of emery cloth, torn into long strips. Remember that when steel is dead hard it is very brittle and that it is liable to break if allowed to drop on anything hard. After it has been sufficiently polished, the next thing is to temper it, that is, to make it a little less hard, so that it will not be so brittle. Have your jar of water handy, and warm the tool rather gently just behind the polished part until it begins to change colour. If the change of colour is just at one part only, then move the tool about in, or just above the flame, so as to heat it more generally but not too fast. The polished part should become golden yellow all over, and should then be cooled in water as before. If you are trying this for the first time you had better experiment first on one of your silver steel rods. The colours come just the same, whether the steel has been hardened previously or not, but they do not show well unless the surface is brightly polished. All that they prove is that the steel has been heated up to a certain temperature where the colour shows.

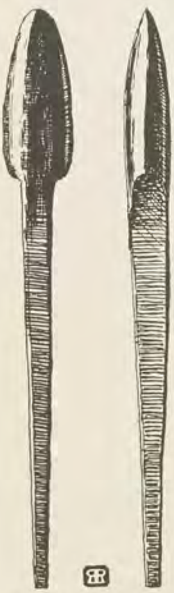


FIG. 93.—Steel burnisher for closing settings

In spite of every care it will occasionally happen that after the stones have been set a necessity arises to *re-solder* some part of the work, where a defect has been found, and if this should be at all near to a stone, then the danger of injuring this latter by heat, while soldering, may be so great as to necessitate the temporary removal of the stone. You will then appreciate the advantage of having used fine silver for the rim of the setting, for it can always be opened, and later on it can be closed down again without much risk of damage so long as the operation is performed with care and patience.

To do this, take a piece of square or round tool-steel rod 4 or 5 inches long, not too thin to hold comfortably, and file one end of it to a long flat taper, like a slender and very minute screwdriver (Fig. 94), only that it must taper down to a knife-edge at the end, and this should be about $\frac{1}{32}$ inch in width and almost as thin as the blade of a small knife. The edges of this thin part must be rounded, or smoothed, just enough to prevent them from cutting the silver. This tool should now be hardened and tempered. When hardening be very careful not to overheat the thin part, but rather let the heat travel from the thicker part against which the blowpipe flame should be directed. And similarly, when tempering, do not allow the flame to come near the thin part, at first, at all events, but apply the heat to the thicker part, an inch or so away from the thin end, until the yellow colour travels down to the end of the tool,

FIG. 94.—Tool for opening settings.

and then let it deepen to a dark golden brown at the tip and quench it in water again as before. The thicker part of the tool, where you have been applying the heat, will probably have changed through purple to blue, which means that it has parted with most of its hardness. But that does not matter for our present purpose so long as the thin end is hard enough not to bend, and yet not so hard as to be very easily broken. It is not absolutely necessary that this tool should be hardened and tempered, but unless that is done it will be very liable to bend.

With this tool you should be able to remove a stone from a plain collet setting without causing much damage to the rim.

The thin end must be very gradually and cautiously insinuated between the stone and the rim of the setting until it almost reaches down to the ledge, but not quite. Then by exerting a *very* slight amount of leverage the rim can be stretched the least bit away from the stone, and when this has been done all the way round the stone will be quite

free to come out, especially if you help it by a sharp pull with a setters' wax point (Fig. 95).

This costs a few pence, and is useful in picking up precious stones and trying them in their settings. It is simply beeswax mixed with resin and, perhaps, a very little tallow in certain proportions, so that when pressed against a stone it sticks very firmly to it.

FIG. 95.—Setters' wax point.

A makeshift substitute for the setting opener (Fig. 94) could be made out of a small bradawl by grinding down the end, or if you have *repoussé* punches, it is just possible that, with a little grinding, one of these might do.

There is considerable danger of chipping the edges of the stone during this operation, and even of cracking it right across, if it is of a brittle nature. Opals and opal matrix are especially liable to damage in this way, and so are emeralds. This danger is increased if the steel opening tool is pressed right down on to the ledge of the setting, because if the setting fits the stone accurately, there cannot be any room for the tool as well, and it is nearly sure to chip the thin edge of the stone if the tool is forced all the way down, around the edge of the stone.

Occasionally, when, for one reason or another, it is necessary, if possible, to avoid the risk and trouble of taking a stone out of its setting after the rim, or collet, has been finally closed down, it *may* be possible for the stone to be sufficiently protected from being damaged by heat by means of a wrapping of many folds of damp tissue paper. This method, however, is itself by no means free from danger, and if the stone in question is *valuable*, an inexperienced craftsman had better not make the attempt. If wet tissue paper *is* used, it must be moistened afresh if the heat of the flame seems at all likely to dry it, just as was described on pp. 194, 195.

CHAPTER XLIV

DECORATION OF SETTINGS

The next question which has got to be considered is that of ornamenting the collet itself. But it doesn't generally pay to put in decoration as an afterthought, or perhaps it would be better to say that, if such a course *is* adopted, the result is not likely to be quite successful from the artistic point of view, because most probably the decoration will have to be done in a more or less makeshift fashion—that is to say, at a disadvantage, and only by means of overcoming difficulties which would not have been there if the ornamentation had been considered beforehand and, consequently, done at the right stage.

Why, then, were you not told about this at the proper time? Well, you see, that would have interrupted the description of other processes in a rather undesirable way. Because, although the actual decoration of a plain collet setting may only be the work of a few minutes after you have made all your preparations and gained the necessary experience, it is none the less true that the method which you are likely to use most frequently for that little job is really a part of a rather important branch of metal working which by itself absorbs about five chapters. And so it really was quite necessary to postpone the consideration of this little detail until after the first stone was, let us hope, well and truly set. All that it means is that we are now going to consider in what way it will be practicable and proper to decorate the collets in the *next* job where stones are going to be used. And as in this book we are limiting ourselves to the use of plain collet or band settings, so, for their orna-

mentation, rings of twisted or beaded wire will be all we shall want.

In fine elaborate pieces of work the settings, even if they are still really of the band or box description, may easily have much beautiful work lavished upon them. They may be built up out of many parts, with subtle gradations from square to octagonal and from octagonal to round, with steps and buttresses and columns and pilasters and openwork galleries and so on, just like tiny bits of architecture, and, naturally, some of these minute constituents may even be enriched individually by mouldings and carving, or inlay or enamel.

But the most that you should attempt in your early pieces would not amount to more than two or three plain wire steps around the base of the collet, with a fine twisted or beaded wire ring in one, or possibly sometimes in two, of the angles which are formed by the projection of one wire band outside of another.

In that connection it is as well to include a word of warning.

When beaded wire is used in jewellery work, it is wisest, as a general rule, to use none except the very finest that is made, which measures $\frac{22}{1000}$ths of an inch in diameter.

There *are* exceptions, and Fig. 71 (p. 162) may be instanced as one of these. Here the pendant is on rather a massive scale, and a comparatively coarse beaded wire seems to look all right when it is used, as in this case, to emphasise some of the main lines of the design.

But decorating a collet setting is another matter, and if beaded wire is selected for this, it will probably be a safe rule to use nothing except the smallest size which is made, and, most unfortunately, that is at least one size smaller than the smallest size which is usually procurable (·031 inch diameter). This size looks much too coarse for the purpose.

Of course, it means a lot of bother to get the ·022 inch size, especially as 2 or 3 feet of it is about as much as you are likely to want, and this, like many other things, points to the usefulness of co-operation between several workers in a craft.

However, there *is* another way out of this particular difficulty, because it is not really so very easy to distinguish the difference between the finest beaded wire and a *very* close twist made of two lengths of the finest silver wire which it is likely that you will be able to draw—that is to say, wire which is only $\frac{11}{1000}$ths of an inch in diameter. Very much finer wire than that is used for many purposes, as, for example, for tying up fine fretsaws into bundles, but wire drawn through the last hole in the smallest drawplate which is sold by the London jewellers' tool dealers (Fig. 15, C, p. 38) measures about ·011 inch, and in that plate there are only ten gradations, the diameter of wire which has been drawn through the largest hole in the plate being about ·022 inch.

The finest sizes of wire are drawn through holes in rubies, and naturally they are very expensive. The above-mentioned drawplate (Fig. 15, C) is quite costly enough, but you will probably find that almost indispensable, sooner or later, if you aspire to produce dainty-looking work, and with wire which is about $\frac{11}{1000}$ths of an inch thick you can easily make a very fair imitation of the finest make of beaded wire. That may seem rather a funny way of putting it, because a fine twist is in itself such a beautiful thing that it seems perverse to want to make it look as if it was *not* a twist.

The explanation is that there *are* places where the slanting lines of which a twist is composed deceive the eyes into imagining that the surface upon which the twisted wires rest actually slopes itself. That is to say that the object is out of truth, which is very fidgetting and unpleasant. That effect may often be counteracted by placing another twist, whose lines slant in the opposite direction, near to the first one. But you can't always do that, and you don't always want to; and so where the effect desired is a single *level* row of the tiniest specks of bright light contrasting with a comparatively broad plain surface, an effect which, although rich, will also be *restful*, the finest possible beaded wire is what you want, and if you can't get that, then the tightest twist of the thinnest wire which you can draw.

The reason why the twist must be so very tight is that the lines of a twist *slant* less and less as the *tightness* of the twist is increased (see Fig. 99, p. 242, and Fig. 105, p. 255), and the particular effect which we are aiming at just now is that of a row of minute specks of high light without any suggestion of slanting lines.

A still richer effect may be obtained by adding a very little gold to the silver from which the wire is drawn for the above-mentioned twist.

Quite a moderate proportion of added gold will make a difference, or there is really nothing very extravagant about using, say, 9-carat gold wire for the whole of a tiny enrichment like this wreath of small twist.

A further decoration is easily provided by first surrounding the base of the collet with a ring of very small flat or square wire, and then by fitting the ring of twist on outside of this. By that method two additional minute surfaces and angles are provided for the play of light and shade, and it should not be forgotten that in jewellery, decorative effects are almost always produced just by means of lines and dots or patches, whether these be of light or of shade. Perhaps this is true of all beautiful things except, possibly, a few which rely entirely on their colour.

Parallel lines, whether in the same or in different planes, varying by slight, but carefully proportioned, gradations or steps, constitute some of the jeweller's trustiest friends. Their effect should always be to enrich ; quite possibly, of course, it may be *too much*, but all these things depend upon the judgment of the designer, and he, as we know, ought, whenever that is possible, to be the craftsman also.

CHAPTER XLV

CONCERNING TWISTS

If any reader, with patience and application, has followed all the exercises which have been outlined or suggested up to this point, he will not need many working instructions to enable him to pursue investigations into the methods of making twists and plaits; but there are a few essential points which it may perhaps be well to enumerate.

In the first place, it will be appreciated readily that, in order to make an even, regular twist, whatever wire or wires are used, each and all of these must be thoroughly and evenly annealed before the twisting is begun.* It will also be evident that, if the twist is to be a close one—that is to say, one which has a great many turns—it is quite possible that one or more additional annealings may be necessary as the work progresses in order to prevent any of the wires from snapping asunder under the very severe strain that can easily be put upon them by this process of torsion. Also, before beginning to twist the wire, it must be made perfectly straight, either by stretching it or, in the case of beaded wires, which will not stand much stretching, in the manner which is explained lower down.

The strain which is exerted upon a wire in the process of twisting is so great that compound twists, when they include beaded wire, must first be made with a temporary plain wire to fill the place which will be occupied by the beaded wire later on. This temporary plain wire must obviously be of the same diameter as the beaded wire. The plain wire is unwound and removed after the twisting is finished, and

* See p. 204.

the beaded wire is then inserted in the space left by it without any risk of breakage.

As beaded wires, on account of their natural weakness, cannot, like ordinary wires, be pulled out in order to make them straight, they must be straightened by light tapping with a wooden or horn mallet on a flat bench.

For this and most other kinds of " setting true " a piece of cork linoleum is useful. It should be neither very thick nor very thin. If it is laid on a solid, smooth, flat surface of metal, stone or wood, it allows the wire or sheet metal which rests upon it while being set to yield a little under the strokes of the mallet or hammer without much risk of bruising or crushing the surface of the object which is being set.

A raw-hide mallet is, perhaps, the best tool to strike with in such cases, but an ordinary wooden mallet, in careful hands, is fairly safe. Hammers made of lead are good, also, or an ordinary steel hammer with one or more thicknesses of cloth or leather stretched over the flat face and bound round the neck of the hammer is quite useful.

But, to return to the question of the effects which we can obtain by twisting and plaiting pieces of wire, we must first realise that any wire which has one or more flat sides will give a decorative effect when twisted by itself, but that, in order to produce an effect with perfectly plain round wire, at least two lengths must be twisted together ; while plaiting requires at least three lengths or strands.

Where a considerable number of wires are to be twisted together, it is often necessary to solder them all together *just at the extreme ends* before twisting. It is also often necessary to bind all the wires together temporarily while they are in straight lengths with fine iron binding wire or with thread, in order to make sure that they shall all be kept in their proper relative positions during the early stages of the twisting, when otherwise there might be a danger of their " crossing." When the wires which are going to be twisted are first bound together to prevent " crossing," then, if the binding is done with wire, this must be wound round

in the direction opposite to that which the twist will take, so that as the twist progresses the binding wire will come gradually loose. If the binding wire took the same direction as that which the twist itself follows, it would get tighter at each turn, and would finally cut into the surface of the twisted wires and permanently disfigure them.

Wires for very small twists may be conveniently held in the pin tongs or slide tongs while being twisted. Larger wires will often require a hand vice to hold them securely

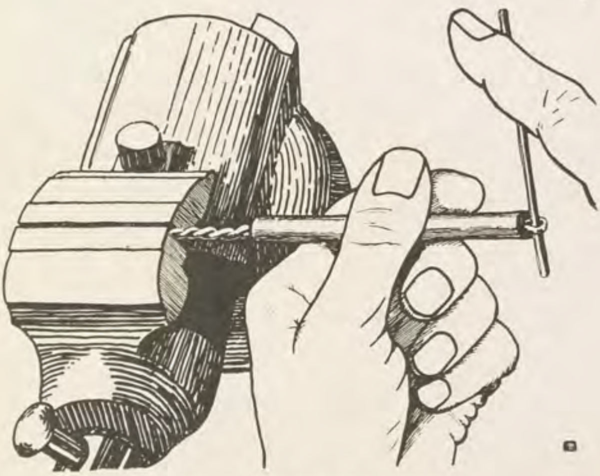


Fig. 96.—Making a twist by hand.

enough for this purpose, but beechwood clams will serve for most of the twists which the jeweller is likely to need, if a hand vice is not available.* If you have none of these things, then two pieces of fairly hard wood screwed together will probably serve.

When a long length of plain twist has to be made, if no lathe or polishing spindle is available for rotating it quickly, then the best plan is to fix one end of the wire or wires in a vice, or even by a few turns round a nail in the bench. When one end has been secured, the free end has a loop

* The above-mentioned tools are illustrated in Fig. 19, p. 45. Pin tongs are perhaps better known as broach holders or small tool holders.

made in it, which is passed through a short bit of tube held in the left hand, and this loop is threaded on to any small straight rod from 3 to 6 inches long, which will prevent the wire from slipping back through the tube and so enable you to keep the twist tightly stretched while it is being made. The rod can then be spun round and round with the first finger of the right hand so as to twist the wire very rapidly. If the tube is small in diameter, a long French nail will do very well for the rod.

The tube need not be of metal. For Fig. 96 a piece of bamboo was used.

Quite a long length of twisted wire can be made quickly enough in this way.

CHAPTER XLVI

HOW TO SOLDER VERY SMALL TWISTS

THE very smallest twists are generally made of pure unalloyed silver, ordinarily described as "fine" silver, and the reason for this is that these very minute twists are apt to melt while being soldered, and that *fine* silver will, without melting, stand exposure to a temperature somewhat higher than that which *standard* silver will bear, before *it* melts.

Fine silver is also used for plaits when it is desired to make them very close, because it is so much softer than standard silver, which is stiff and springy. But it must be borne in mind that the softness of fine silver makes it unsuitable for parts which will be exposed to any considerable amount of wear and tear, as has been explained already in Chapter XL. in connection with settings for precious stones. These remarks as to the use of fine silver apply equally to fine gold.

When the smallest twists are being soldered, "easy" solder is sometimes used—that is to say, a kind of silver solder which will melt at a rather lower temperature than that which is necessary to fuse the best hard solder.

In soldering bands or rings of these small twists to more solid parts you must take great care to heat the work gradually and *evenly*. If the twist is caught by the heat too suddenly it will become red hot in an instant, and it will expand so much quicker than the surrounding parts, that there will be a great danger of its bulging out loosely. Should

that unfortunately happen, even if it is only to a slight degree, you will find that it will be impossible to persuade the excess of metal (resulting from the sudden expansion of the twisted wire ring) to gather itself up again, and you will never succeed in coaxing the twist back again so as to make it look as it did before.

Consequently, the only sensible thing to be done is to try if it is possible to get the twist off without spoiling it altogether. Of course, if the solder has not melted at all there should be no difficulty about that. But if the twist is soldered to the job at a few places, the best chance will be to cut it through in the middle of the loose part, and then, gently pulling it back by one of these loose ends, to try if you can manage to strip it off. Then, if you have been successful, you can solder it into a ring of the right size once again and have another try. It is a very difficult and nervous job to unpick a soldered joint *while it is red hot*, and if there are some parts of the twist which have been so firmly stuck by the solder that they won't strip off without being made hotter than seems safe, it will then be wisest to cut or file away all those parts which can't be pulled away.

It is impossible to solder small twists neatly unless they fit tightly round the parts they encircle. But while controlling and regulating the flame so as to avoid any *sudden* heating of the twist, this latter must not be allowed to remain too cool or else the expansion of the parts which are enclosed within the ring of twist may easily burst it.

A length of fine twist which is to encircle a more solid part should always have its ends securely soldered together before it is applied to the part to which it is going to be attached, and the ring of twisted wire which is so made should be slightly too small, so that it must be stretched a little in order that it may spring on to its place. If the ring of twisted wire is to be soldered around a band or collar which has a projecting rim of such a kind as to form an angle for the twist to lie in, then the springiness of the

twist may suffice to keep it in position while it is being soldered.

But if there is no projection of that kind, or if the twist has to be soldered on to the edge of a disc or of another wire, then a very slight nick must be filed or cut for the twist to lie in.

Sometimes the best way of holding a fine twist in the desired position for soldering is by means of a series of very minute spurs of metal, these being produced by extremely slight cuts made with the sharp point of a spit-sticker or of a small bull-sticker (Fig. 29, L, p. 78). To do this, apply the point of the tool at an angle of about 30° to the surface of the metal to which the twist has to be soldered, so that the direction of the tool is at right angles to the line of the twist, and in such a way that the point of the tool is so near the twist as *only just* not to touch it. Then press the tool a little so as to make it dig into the surface of the metal *very slightly*, and it will push up a tiny spur or shaving of metal against the side of the twist. The tool must be sharpened to such a keen point that it will cut with a degree of pressure which is so slight that you hardly know that you *are* pressing.

A series of these spurs at short distances apart will hold the twist very firmly, and neither they nor the cuts made by the graving tool should show after soldering.

The solder for securing *very* fine twists may be applied in the form of dust, which is produced by filing a piece of the solder ; for otherwise it is almost impossible to put it on in small enough quantities, and if there is too much solder the twist will be " blinded," that is to say, it will be flooded with solder, and will no longer look like a twist. This " dust " solder is moistened with borax water when it is applied. Even so, there is quite enough risk of putting on too much solder in places, and a sharp look-out should be kept to provide against this danger.

By far the best way of guarding against the danger of overheating very small twists or other exposed parts while they are being soldered or annealed is by using a simple

little apparatus called a turntable, on which to support the work, so that it may be an easy matter to keep it in constant circular motion while it is exposed to the heat of the blowpipe. Thus danger is reduced to a minimum by spinning the work round and round (but not too quickly), while the flame of the blowpipe is being directed upon it, and by watching attentively for the slightest sign of any one part becoming prematurely heated, so that, whenever it may seem to be desirable to do so, you may be ready to check or turn away the blowpipe flame instantly, even if it is only kept away for a second.

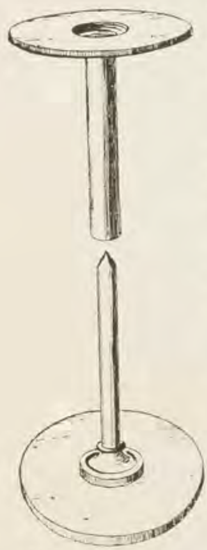


FIG. 97.—A turntable.

A handy gas fitter will soon make you a turntable, as shown in Fig. 97 if you cannot do it for yourself. It is made of two circular iron flanges, say, $4\frac{1}{2}$ inches in diameter (sold by most ironmongers), each one being provided with a suitable reducing socket.

The lower flange, which forms the base, supports a vertical round steel rod about 5 inches long, pointed at the top end. A short length of iron gas pipe (a little shorter than the rod) is plugged at the top so as to rest upon the top of the rod, and is screwed into the top flange which forms the table.

This appliance should not cost much and does not need to be "an engineer's job" by any means, but will serve your purpose equally well if quite roughly made. The top flange will support a charcoal block; or a soldering wig which has had the strong wire handle removed; or a movable tray, such as the lower part of a tongue tin, which has been cut down so as to leave a rim about 1 inch high. This tray should be filled with small pieces of pumice stone or fragments of fire brick, or charcoal, or even of clean and well-burnt cinders. A small soldering tray of this kind is a very handy appliance, but don't on any account ever use either

it or your soldering wig, or your charcoal block for *soft* soldering, because a tiny fragment of soft solder (which is composed of lead and tin) may very easily ruin a bit of silver or gold work.

CHAPTER XLVII

MAKING A SAMPLER OF TWISTS

THE use of twisted wire as a decoration for the bands of plain settings does not, as a rule, call for a stock of sample patterns, because, as we have already seen, all that you will generally want for that purpose will be some very thin wire twisted very tightly. But, later on, you will be sure to want to use decorative twists in larger and more conspicuous ways, and then you will soon realise how great a convenience it is to have a good supply of specimens of a number of different varieties of twists, and in as many different sizes as possible. Except perhaps after many years' experience, there is only one safe way of deciding precisely what form of twist will look best in any given place, and that is by placing in position first one and then another sample bit of all the likely varieties which are available, and by comparing effects one by one. So now it is time to set to work at making a sampler of twists. That is a thing which every craftsman should do for himself. It is interesting and instructive to make your own experiments and, by doing so, to discover for yourself the different results of various degrees of twisting on wire of various sections, whether the wires are twisted singly or in association with others.

If you feel in doubt as to how to set about it, the following is a pretty safe way of making a start which you can develop as you go on according to your own fancy.

First take a good long piece—say, about 10 feet or, preferably, more—of copper wire which you have drawn

down as thin as you are able to do, keeping a note of the hole through which it was last drawn, and if you have a micrometer or a feeler * gauge and callipers, give its diameter in thousandths of an inch.

Anneal the wire carefully and cut it up into ten equal lengths. Double each of these lengths over (Fig. 98); pull them out till they are quite straight, and twist one of them from *right* to left *very* tightly, annealing the wire as soon as you feel it getting hard. When you have twisted this as tightly as you can, take another length and twist it from *left* to right with exactly the same degree of tightness, so that, when both are laid side by side, all the turns come precisely opposite to each other along the entire length of the two twists (Fig. 99, A).

Next, make another pair of right and left-handed twists similar to those which you have just made, only twist them rather less tightly (Fig. 99, B). The third, fourth and fifth pairs (Fig. 99, C, D and E) should now be dealt with, each pair being rather less tightly twisted than the preceding pair, so that eventually you will have got sample lengths of fine twist in five different gradations of tightness, but all of them made from wire of exactly the same thickness.

FIG. 98.—A piece of wire doubled over ready for twisting.

Next cut off about 3 inches from each of your samples and, taking care to leave about an inch in the middle of each of these 3-inch lengths unaltered, flatten each piece slightly at one end, and rather more heavily at the other end (Fig. 100). This can be done well enough with a jeweller's hammer, but, of course, more neatly and evenly with a flatting mill. You will find that the effect of flattening is pleasantest on the looser twists, where there is room for the wire to expand comfortably when it is flattened (see Fig. 100).

* See Note C., p. xlii.

Then lay these samples together in pairs, side by side, and note the effect, and afterwards put a straight length of plain wire in between each pair and again note the effect (Fig. 100). These samples should be of great service for reference.

In Fig. 99 each individual length of twist has its own loop of *un*twisted wire left on for convenience of measurement at any future time, when more twist of the same size is wanted. But the samples in Fig. 100, owing to both of their

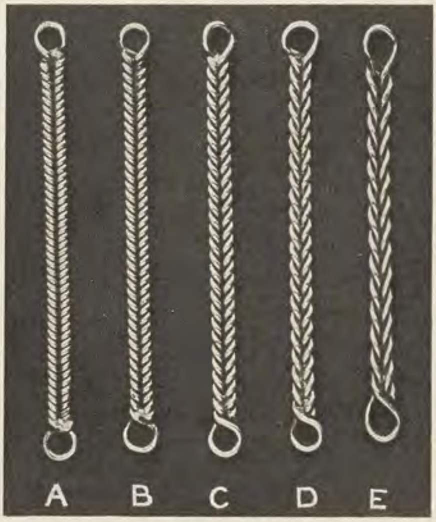


Fig. 99.—Five pairs of right and left-handed twists in varying degrees of tightness, but all made from wire identical in size.

ends being flattened, cannot so easily have a record left to show the size of the round wire from which they were made.

If, however, each pair of twists be soldered together as indicated in Fig. 100, it would be easy at the same time to solder on a ring of the right-sized wire at one end. You could then not only measure the size of the wire, but also keep your samples safely together, while still able to try them separately in any required position on a job in order to see which one looks the best.

Now draw another good long piece of stouter wire, say, about 8 feet long, and just a shade thicker than the tight

twist which you have made. Anneal this and cut it up into four equal lengths, and pull these out with the pliers at one end while the other end is held in the vice, one wire at a time, but only just enough to make them perfectly straight. Then divide each of these four lengths into eight equal parts, which should give you thirty-two 3-inch lengths, and read again the whole passage on pp. 232, 233, which relates to the simultaneous twisting of a number of wires, in order to refresh your memory on certain important points before

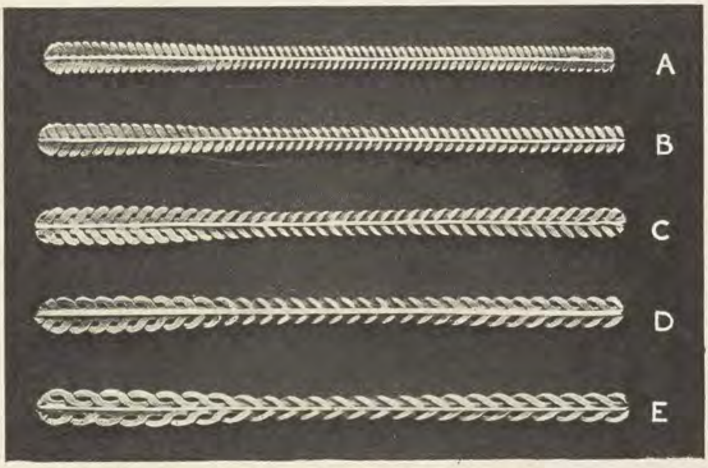


FIG. 100.—The same twists as in Fig. 99, but flattened and separated by plain wires.

proceeding to make a fresh series of sample twists, using first three, then four, then five, then six and, lastly, seven lengths of wire at a time.

It would be too big an undertaking to make three or four or more samples of each of these groupings in varying degrees of tightness both right and left-handed, and you must use your own judgment, based on your previous experience, to stop the twisting in each case when the effect pleases you, remembering that it is easy to give the twist another turn or two at any future time if you should want to see how it looks when twisted tighter, but that untwisting is not practicable. You will probably find it best to make some of

your new sample twists right-handed, and others left-handed.

Fig. 101 shows the effect obtained by replacing one strand of a multiple twist by a beaded wire, and it will be well to try a few experiments of this kind, either with beaded wire of the same or slightly less thickness than that of the strand which has to be replaced or with a length of very tight, small twist, which will give a very similar effect.

Fig. 101.—A compound twist, made of one beaded and six plain wires.

After a few trials you will probably succeed in removing a single strand from a fairly *short* length of multiple twist by a process of what one may call unscrewing, which has the advantage of leaving the strand which is removed undamaged, so that it can be replaced later on, if desired. Also, it is worth noting that, if you begin to insert the beaded or twisted strand at one end *before* the strand which this is to replace has been completely unscrewed and removed from the other end, then the danger of the other wires being disarranged is almost eliminated.

Next take some fairly stout copper wire, say, about 12 I.S.G., cut off about four short pieces 3 inches or 4 inches long, and flatten them in varying degrees, the first one hardly at all, the last one very much, and the others to intermediate stages. Anneal and straighten these, and, when twisting them, take care to keep a sufficient length at the end of each piece unaltered, straight and undamaged, so as to enable you to measure its thickness and width accurately in case you wish to repeat it at some future time.

Now you will want a few short lengths each of square, flat, triangular and half-round wire from which to make, in each case, some sample twists ; and if you find that you can get wire of other sections, too, so much the better, but remember always to leave enough of the *untwisted* wire at one end so as to show exactly what the twist was made from, and also to flatten a bit of the twist at the other end in order to show what effect that very easily-made alteration will have.

These few experiments will teach you a great deal, and they will give you a valuable stock of records.

Fig. 102 shows how difficult it may be to guess from the appearance of the finished twist what was the original section of the wire or wires from which the twist was made, and this is good evidence of the desirability of always leaving a plain piece of untwisted wire at one end of a sample length of twist.

FIG. 102.—A twist made from wire of half-round section.

By comparing your own experiments with those illustrated in Figs. 103 to 109 and with any others to which you may have access, such as those illustrated in "Metalwork and Enamelling," by H. Maryon, you will soon find out the direction in which to try for any special effect which you may need.

CHAPTER XLVIII

SOME OF THE VARIABLES IN MAKING TWISTS

IF after having made a first sampler on lines such as those suggested in the last chapter you should be fired with an ambition to experiment in a more thoroughly systematic way with the differences of effect obtainable by means of an exhaustive use of the numerous "variables" and an accurate tabulation of the details *and sequence* of all the processes employed, you would be embarking on a journey as to the probable length and complexity of which it would be rash to prophesy.

For the jeweller, however, a large proportion of these variations would only rarely, if ever, be useful, because of the small scale of his work, in which there is generally no room for very elaborate compound twists. Probably, also, *some* of the variations resulting from the use of wire of different sections would be so slight as to be negligible. For example, it is sometimes by no means so very easy to detect the difference between two twists which have been made, the one from square and the other from triangular wire, in spite of the essential dissimilarity of the sections of these two wires. But, then, on the other hand, a much slighter difference in section will often result in a very pronounced difference in the final appearance.

In any case, for the beginner who is in a hurry to get on and to carry a few things through to a finish, quite a few experiments on the lines indicated on pp. 241—245 will be enough to provide him with all that he is likely to need for some time to come.

Figs. 103 to 110 represent a number of trial patterns made

of different sizes and sections, twisted either singly or in groups of two or more, and they give a glimpse of the almost unlimited number of variations which may be obtained by twisting and plaiting.

The experience gained from the *un*systematic and spasmodic trials whose results are there illustrated seems to indicate that there is still room for a course of systematic experiments, in spite of the valuable and extensive series of examples in Mr. Maryon's book. Such an exploration, while it would surely not lack interest, might perhaps prove to be a useful bit of research work. That may sound "high faluting," but let any one who thinks so just try to reckon up how many "variables" there are, and having made that attempt and having perhaps abandoned it, as the author of this book has done, with that discretion which is said to be the better part of valour, let him then allow his imagination to play with the idea of making combinations and permutations in a series of variables which in itself seems almost infinite.

A tool-dealer's catalogue which lies before me contains illustrations of 255 different sections of wire for which drawplates are, or can be, supplied. These differences are, of course, not concerned with size, but only with section. Wires of these sections, when twisted singly, will each one give an effect which is, in however small a degree, peculiar to itself. The twist may be right-handed or left-handed, or first one way and then the other. It may be done with great variety of degrees of tightness; each one of these wires may have its section modified through a series of slight changes, either by being pulled through a hole of a different section to its own, in which case, so long as the second section is not allowed to entirely obliterate the first, it will generally be a new variation differing in some degree from any of the 255 patterns, or the majority of these wires might be modified in a different way by varying degrees of flattening, either between rollers or by hammering. Either of these modifying processes may take place before twisting or afterwards, or at both times.

Besides the variations produced by twisting them singly, any one of these wires might be twisted along with another or with several of the same section ; or with one or more of any of the other 254 sections ; or with any combination of any of these ; or with a previously made twist, either right-handed or left-handed, of any such combination (whether used with or without modification, by flattening or otherwise, either before or after its torsion) ; or by the subsequent

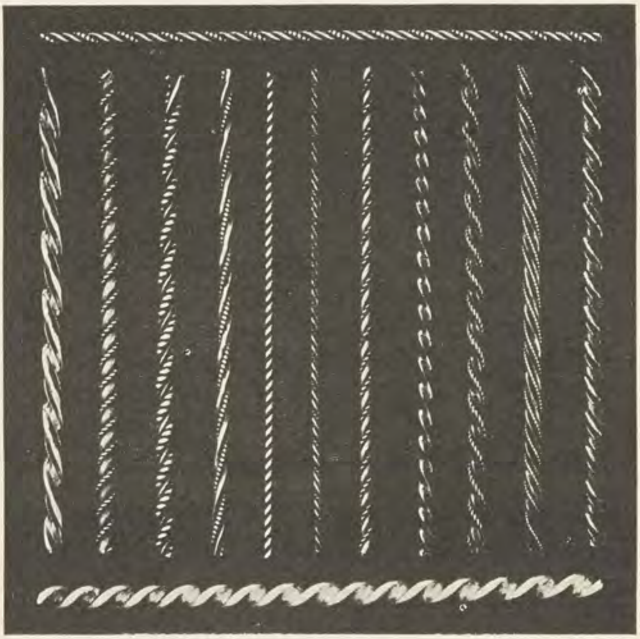


FIG. 103.—Simple and compound twists.

insertion, after twisting, of any such additional member into one or more of the flutes produced by the twisting of the principal wire. Besides all these variations there would also be another series resulting from also using, in one of the various ways already indicated, plain round wire of any size or one of the several patterns of beaded wires, and these, also, might be used either in their ordinary state or modified by flattening or otherwise ; or, instead of beaded wires, the combination might be with plaited wires. . . . .

If any one should feel a desire to put these matters to the proof, he will want some samples of wire of many different sections with which to make trial twists.

It is, however, only right to repeat the warning that experiments of this kind are apt to absorb an enormous amount of time, and that they are not necessary for the production of quite satisfactory pieces of unit jewellery.

Many charming and interesting effects of both simple and compound twists can be obtained with nothing more than just ordinary round wire of various sizes, especially when some of it has been flattened, and we saw on p. 242 that, even without varying their size, two round wires alone are capable of giving a surprisingly wide range of effects between the two extremes of very open and very close twisting.

However, in case there should be even one reader who wishes to find out for himself what there is to be learnt in these processes, here are a few suggestions as to how to set to work.

If you have no variety of drawplates of your own, then try to make friends with some one who has plenty of them, say, with a jewellers' tool dealer, for instance. Try to persuade him to let you have (for experimental purposes) a stock of short lengths of copper wire, some of which have been drawn through every drawplate he possesses, so as to give you a series of samples of all the different varieties of section which he can supply with the exception of plain round wire. These samples should be in, say, three different sizes, one of which should in each case be the smallest size which the drawplate will give.

Ask your friend also to pass some round copper wire through his flatting mill for you, so as to give you a series of wires with rounded edges, but in graduated degrees of flatness or of thinness. If he jibs at that, then do your best with some round wire and a hammer and a good supply of patience. Round wire may also be flattened by pulling it through a drawplate of the kind which is ordinarily used for making flat wire—that is to say, through a plate which has oblong-shaped holes of suitable size—but there are

objections to that method. The first pull through the plate is apt to make so *slight* a pair of flats in the surface of the round wire that these flats will sometimes not provide enough " lead " to guide the wire properly at the next pull through, with the result that the wire may get twisted and, consequently, flattened on *other* parts of its surface at the second pull.

Another objection is that, as the round part of the wire may rub against either one or other of the square ends of the hole in the drawplate, these round surfaces of the wire are thus apt to get a little scraped and damaged instead of being left, as we want them to be, perfectly smooth and full. But when only a very slight amount of flattening is required, not more, perhaps, than that which a single hole in the drawplate will give you, then it is a safe enough method.

Round wire which has been only *very* slightly flattened gives a particularly nice " fat " effect when twisted, and it is an effect as different as possible from that obtained from wire which has been more noticeably flattened until it has been reduced to, say, about half of its original thickness.

Second-hand drawplates or broken pieces which are quite serviceable can often be bought for a shilling or two at a tool dealer's, or even sometimes off a hawker's barrow, and if you are at all lucky, you may happen on plates with holes of unusual shape, which would be costly things when new.

When you have by one means or another got together a nice store of wire of many different sections, all of which must, of course, be carefully annealed before you begin your twisting experiments, think out some systematic way of identifying the wire used in each experiment and of recording with great exactitude every stage in each experiment in the precise order in which the stages came. Of course, you do really need a micrometer gauge for a job like that if you are going to do it thoroughly, but at the time when these words are written micrometers are expensive.

Some information will be found in Note C., p. xlii, regarding the possibility of accurately measuring small wire

or thinnish sheet metal by means of callipers and a feeler gauge, when no micrometer is available.

But no really systematic and useful experiments of effects to be got by twisting wires could be properly tabulated unless the measurements are within, say, half a thousandth of an inch of accuracy.

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